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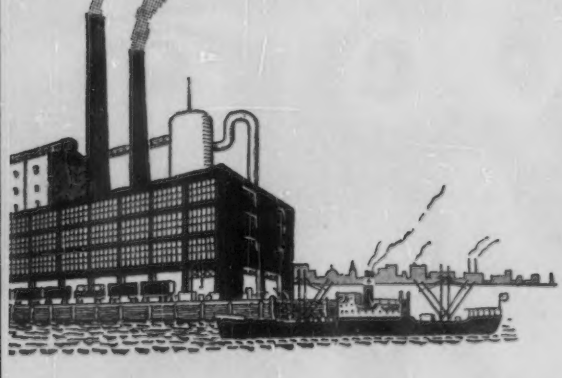

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ECONOMIC GEOGRAPHY

VOL. 33 JANUARY, 1957 No. 1

RAILWAYS AND PORTS IN FRENCH WEST AFRICA*

Benjamin E. Thomas

The article presented here is one of a series in which Dr. Thomas, of the University of California at Los Angeles, has been dealing with transportation in Africa. Previous articles appearing in Economic Geography *have been "Railways of French North Africa" (April, 1953) and "Motoring in the Sahara: The French Raids of 1951–1953" (October, 1953).*

THE problem of transportation is a crucial one for most parts of tropical Africa. The coasts are generally inhospitable, with few good harbors, and all the major streams descend over falls and rapids from interior plateaus. Artificial harbors have, therefore, been developed in a number of places, and railroads serve as feeders to the ports and as connections to inland navigable segments of rivers. Although motor traffic has attained a moderate degree of importance in certain sections of Africa and the airplane is making great gains in passenger and express service, the short coastal rail lines usually carry the bulk of the raw materials to the coast for export and handle most of the return flow of processed foods and manufactured goods.

The Belgian Congo has long served as an outstanding example of the complexity and high cost of using a combined river and rail system for export from interior Africa. French West Africa (or "A.O.F.," for "Afrique Occidentale Française") is another immense colony with the mass of the area lying far from the coast, and it also has a major river, the Niger. But basic contrasts in the geography of the two colonies give the transport problem a different aspect. The wealth of French West Africa is at present in tropical agriculture near the coast rather than in minerals; the Niger River lies in the Sudan with a flow that supports only seasonal transport, but may provide irrigation for a considerable area; and the Sahara barrier lies on the north.

The discovery and exploitation of minerals is often a spur to the rapid construction of transport lines for export, while commercial agricultural development in a remote region is usually dependent upon, and subsequent to, the gradual spread of transport facilities into the interior. Thus in the Congo a radiating pattern of transport lines carries copper outward to seaports from the interior mines of the Katanga, while

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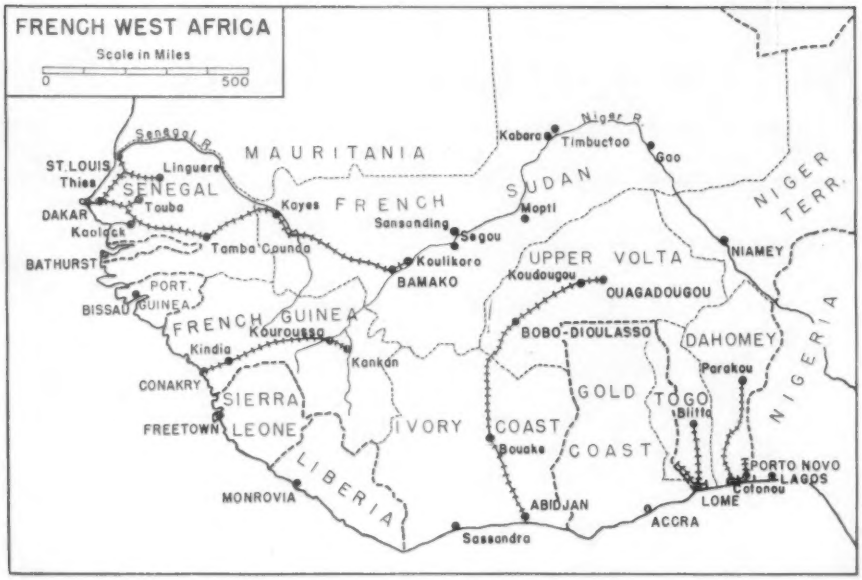
FRENCH WEST AFRICA
Scale in Miles
0
500
Senegal R.
Niger R.
MAURITANIA
Kabara
Timbuctoo
Goo
ST. LOUIS
Thies
Linguere
SENEGAL
DAKAR
Touba
Kaolack
Kayes
FRENCH SUDAN
Sansanding
Mopti
NIGER TERR.
Tamba Counda
Segou
BATHURST
Koulikoro
UPPER VOLTA
NIAMEY
Koudougou
BAMAKO
OUAGADOUGOU
PORT. GUINEA
BISSAU
FRENCH GUINEA
Kouroussa
BOBO-DIOULASSO
DAHOMEY
Kindia
Kankan
Parakou
CONAKRY
GOLD COAST
TOGO
NIGERIA
SIERRA LEONE
FREETOWN
IVORY COAST
Bouake
Bitta
PORTO NOVO
LAGOS
Cotonou
LIBERIA
MONROVIA
ABIDJAN
LOME
ACCRA
Sassandra

FIG. 1.

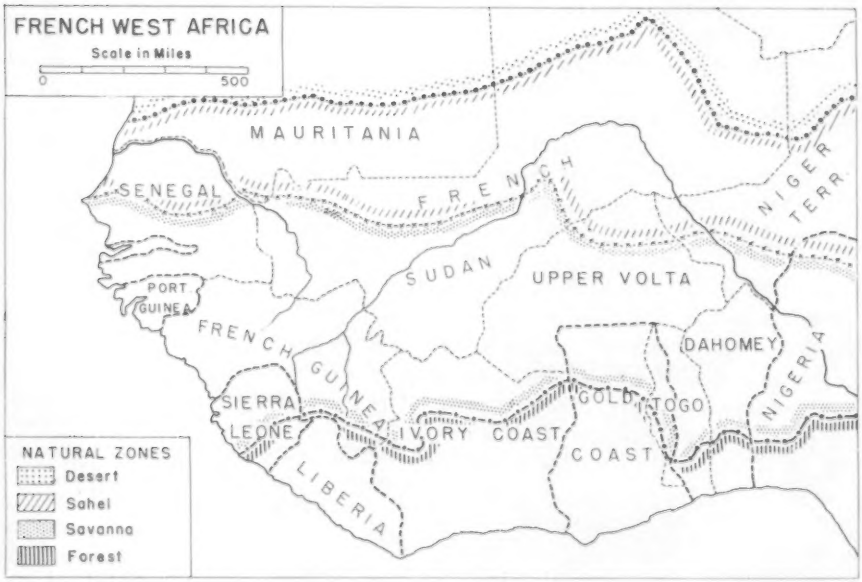
FRENCH WEST AFRICA
Scale in Miles
0
500
MAURITANIA
SENEGAL
FRENCH SUDAN
NIGER TERR.
UPPER VOLTA
PORT. GUINEA
FRENCH GUINEA
DAHOMEY
NIGERIA
SIERRA LEONE
IVORY COAST
GOLD COAST
TOGO
LIBERIA
NATURAL ZONES
Desert
Sahel
Savanna
Forest

FIG. 2.

A.O.F. has a number of rail lines that serve ports on the western and southern coasts and reach inward toward the Niger. The short titles for the major railways illustrate the pattern: Dakar-Niger, Conakry-Niger, Abidjan-Niger, and Benin-Niger. There is even a railway in North Africa running southward a short distance from eastern Morocco to the coal mines in the Sahara near Colomb-Béchar which certain factions hope to complete as a trans-Saharan line to the Niger; its official name is the "Mediterranée-Niger." Of all the lines that extend toward the Niger, only two reach it: the Dakar-Niger and the Conakry-Niger (Fig. 1). It is primarily the rail system rather than the Niger River which supports the present traffic, and a big problem for the future is to discover an economical means of transport for the potential produce of the Niger Valley.

GENERAL FEATURES OF THE TRANSPORT PROBLEM

The shape of French West Africa is the result of the penetration and conquest of Africa by European powers from coastal holdings. France and Britain both obtained and kept several footholds on the Guinea Coast, while Portugal lost most of her earlier trading stations, and Germany entered so late that little unclaimed coastal territory was left. All nations made slow progress northward because of commercial policy, dense forests, disease, unnavigable streams, and unfriendly natives. But on the west coast, in Senegal, France had the scrub and grassland (sahel and savanna) corridor between the desert and the forest (Fig. 2) which made eastward progress less difficult, and the Senegal and Niger Rivers even added segments of navigable streams. Because of these and other factors, France was able to extend her territory far inland from the Senegal coast and make connection with the northern parts of French Guinea, Ivory Coast, and Dahomey. The British territories of Gambia, Sierra Leone, Gold Coast and Nigeria, together with Portuguese Guinea, German Togoland, and independent Liberia, were left as enclaves between French territory and the sea. After World War I, Togoland was taken from Germany and divided into French and British mandates.

Although the savanna corridor is very useful to explorers, nomads, and Moslem pilgrims, it is not an economical route for modern transport. Both the Senegal and the Niger have low periods when they are unnavigable, and both are obstructed by rapids. Eastward from coastal Senegal, the cost of land transport increases rapidly. Distances are great, the Dakar-Niger railway covers only part of the route, many roads are impassible during the wet season, and few products can stand the cost of transport.

The British and French colonies along the Guinea Coast have both seaports and feeder railways for local needs, but the unification of the French lines in order to exploit the vast interior is a unique and complicated problem. When one views the commerce for French West Africa as a whole, the concentration of activity along the western and southern coasts is startling. Five ports —Dakar, Kaolack (on the Saloum River southeast of Dakar), Conakry, Abidjan, and Cotonou—handle 95 per cent of the traffic. And the four railways transport 75 per cent of the tonnage passing through these ports.[1]

In discussing the transport problem, it is common to contrast a littoral zone with an interior or continental zone

[1] Percentages are from *Guid'A.O.F.; Afrique Occidentale Française, Cercle par Cercle, 1953–1954*, Gouvernement de l'A.O.F., Dakar, 1954, p. 15.

which is joined to the sea only by Mauritania. The littoral zone can be delimited by starting at the Senegal River and tracing a line parallel to the coast at a distance of 125 miles so that it cuts across Senegal, French Guinea, Ivory Coast, and Dahomey, as well as the foreign enclaves. The French portion of this coastal zone, with a population of about 5 million, includes an overwhelming proportion of the economic resources of French West Africa. It includes about 80 per cent of the peanuts, all of the coffee and cacao, all the commercial timber, most of the oil palms, and all the bananas. This relatively small coastal zone accounts for about 90 per cent of the exports of the country.

On the other hand, the immense interior zone, handicapped by drier climates and difficult transport, furnishes only 10 per cent of the country's exports, but the population is more than 12 million. The cost of transportation is a double disadvantage to many people of the interior. For example, goods imported via Dakar to Bamako often cost 50 to 80 per cent more at Bamako than at the coast, while the products exported from Bamako are worth from 30 to 60 per cent less at Bamako than at seaports because they have to stand transport costs to the coast.

The government of French West Africa claims that the transport problem is one of the greatest handicaps for remote interior regions like the Upper Volta. This territory has almost 20 per cent of the population of A.O.F., but less than 5 per cent of the income. The cost of transporting coastal products like cacao, coffee, and bananas to seaports is a small percentage of the value, while at Ouagadougou, in Upper Volta, the cost of transporting a ton of Karite nuts (shea nuts) to the coast can be double the price paid to the producer. Under such conditions, transportation is a critical item. Present French policy takes account of the problem in many ways, such as in favoring the production of local food to avoid needless shipping, and in stimulating simple transformations (ginning cotton, shelling peanuts, etc.) so that the products can stand the cost of transport. Also, railways and roads are being improved. A new rail line—to be discussed in more detail later—has just been constructed from Bobo-Dioulasso to Ouagadougou.

The traffic pattern of the railways, as might be expected, reflects the commercial dominance of the coastal zone. Traffic, both freight and passenger, dwindles toward the interior. Taking the Abidjan-Niger line as an example (see Fig. 3) there are two daily trains between Abidjan and Dimbokro plus one train that runs three times per week and one weekly train. Between Dimbokro and Bouake traffic diminishes by one train running three times per week. North of Bouake traffic declines by an additional daily train, and finally, beyond Bobo-Dioulasso, there is only a single train running three times per week. The railway from Koudougou onward to Ouagadougou was largely completed at the time of investigation (January, 1954) but was not yet open to passenger traffic.

The ports, under a policy of exporting raw materials and importing processed goods, naturally became the heads of rail lines that penetrated toward the interior. A corollary is that changes in ports and harbors such as a shift in importance from one port to another, the construction of new facilities, or the decline of a seaport under new commercial or political conditions would have important effects on the associated railways.

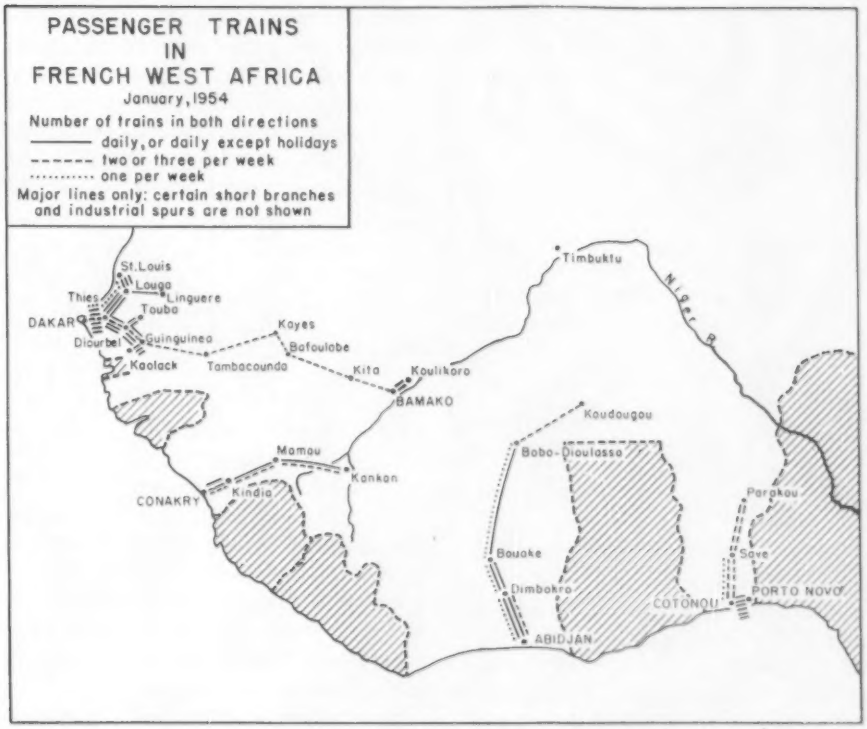

FIG. 3.

Thus the four railways of French West Africa have coastal terminals where alterations followed the story of port development, until the heads of the lines became fixed at the present major port of each coastal territory: Dakar, Conakry, Abidjan, and Cotonou.

The selection of interior routes for the lines, as in other parts of the world, took account of physical and economic geography as well as the political, technical, and financial requirements of the time. The hinterlands of ports changed considerably as railways from different ports were extended inland at varying rates of construction. For some periods, changes were small, at other times, great. During and since World War II, port development in West Africa has probably been greater than in all the centuries preceding, with an important impact on the railways. These features will be examined by tracing the development of each line up to the Second World War, and then considering the present scene.

THE DAKAR-NIGER RAILWAY

Senegal was the first of the French colonies in West Africa, dating from the founding of St. Louis at the mouth of the Senegal River in 1638.

The physical nature of the Senegal River is such that it provides neither a desirable port nor a convenient route of penetration, but it was the best that was offered by a notoriously inhospitable coast. The river has its sources in the Futa Jallon highlands of French Guinea. It runs down the northeastern slopes

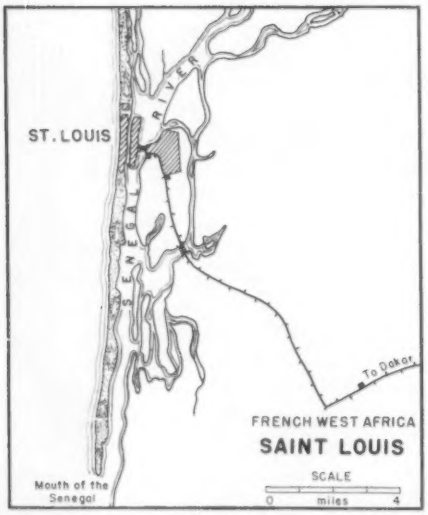

FIG. 4.

toward the interior and then swings northward and westward through the margins of the Sahara to the coast. The alternating wet and dry climate gives the river a pulsating flow, with a high level only during late summer and fall. At flood season the river has considerable sediment which is carried to the ocean or deposited in the lower channels. At its mouth the Senegal, encountering the southward flowing Canaries Current, has been turned toward the south along the coast and the ocean has built an offshore bar, several miles in length, which separates the river from the open sea. At one point, there is a sand bar in the river, parallel to both the outer bar and the mainland. St. Louis is built upon the two bars and the adjacent mainland (Fig. 4). The channels of the river that separate the bars from the mainland are so shallow that they provide only a poor port and prevent large vessels from ascending the river. Even small river steamers can pass the bars only for certain days each month; shifting deposits of sediment often block the channels completely.

In 1677 the island of Gorée, opposite the site of present Dakar (Fig. 5), was occupied by the French, but it was not until about 1850, almost two centuries later, that Dakar on the mainland became a village of minor importance. Although a railroad from Dakar to St. Louis was suggested as early as 1856 as a means of pacifying the intervening country, it was not until 1880 that Dakar became of sufficient commercial consequence to justify approval of a connecting rail line. The Dakar–St. Louis Railway was constructed easily and rapidly (1882–1885) over comparatively level terrain.[2]

Attempts were also being made to improve the connections of St. Louis with the interior. Before the construction of railroads, the easiest method of reaching the Niger River was to go up the Senegal from St. Louis to the rapids near Kayes, the limit of navigation for

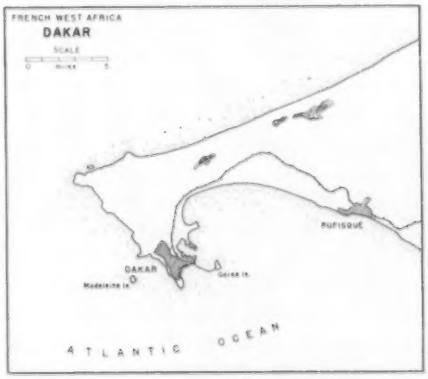

FIG. 5.

[2] Historical data have been obtained from several sources. The most complete are the records of the Regie des Chemins de fer d'Afrique Occidentale Française at Dakar and H. Lartilleux, *France Lointaine*, Vol. 4 of *Géographie des chemins de fer français* (Géographie universelle des transports), Chaix, Paris, 1950. The map of railway traffic (Fig. 3) was compiled from schedules and local inquiry.

river boats during high water.[3] A trail was then followed for over 300 miles to a point near Bamako, on the Niger, where boats could again be used. Even though both the Senegal and the Niger had periods when they were not navigable, the Kayes-Bamako trail, protected by a string of military posts, was the weakest link.

A railway to connect the two rivers was suggested earlier, but not approved until 1880. Construction started in 1881, so that work proceeded on both the Dakar—St. Louis and Kayes-Niger lines at the same time. Building the interior railroad was a much harder task, however. A private company, plagued by the difficulties of transporting labor and materials up the Senegal and working in the torrid frontier region of Kayes (one of the hottest on earth), and other problems, failed after having spent four years in constructing less than 40 miles of railway. During the same period the Dakar—St. Louis line of 160 miles had been completed and put in operation.

In 1891 work was again started on the Kayes-Niger railway. Using first naval and then military forces, the government gradually pushed the line toward the Niger, opening sections to traffic as they were completed. By 1904 the line was in service from Kayes to Bamako and on to Koulikoro.

Bamako is located just above a series of rapids. It is a port for the Upper Niger, navigable during high water from Bamako in the French Sudan to Kouroussa in French Guinea and, by way of the tributary Milo, to Kankan. This portion of the Niger has rocks and bars that make navigation difficult; it is of less importance than the Middle Niger below the rapids at Bamako. The continuation of the railway from Bamako to Koulikoro provided a rail connection around the rapids to join the Upper Niger and Middle Niger, and, of more consequence, to give both sections an outlet to the coast by way of Kayes and the Senegal River.

The Bamako-Kayes—St. Louis route had many obvious disadvantages: transshipment from water to rail at Bamako or Koulikoro, and from rail to water at Kayes; then the seasonal flow of the Senegal; and, finally, the shifting sand bars and shallow port at St. Louis. However, Dakar was growing in importance and its harbor could be improved to provide sheltered wharfs for large ships. From the beginnings in 1880, therefore, the Kayes-Niger railway was considered as a first step toward an all-rail route from Bamako to Dakar. It became a portion of an awkward river-and-rail route only as a temporary measure.

Soon after the completion of the Kayes-Niger line, construction was started (1907) on the railway to join Kayes to the coastal line. Thiès, on the Dakar—St. Louis line, was the closest station to Kayes; it became the seaward terminal of the new Thiès-Kayes Railway. Later, the situation of Thiès at the junction of the trunk lines led to its growth as an important railway town, with the major repair shops and storage facilities for the railways of Senegal and the French Sudan.

While the Thiès-Kayes line was being built, the other coastal colonies of French West Africa were also extending railways inland. In French Guinea the line from Conakry was completed to Kouroussa on the Upper Niger in 1911 and to Kankan on the Milo in 1914 (Fig. 6). Since the Thiès-Kayes Railway was not yet

[3] Information on navigability of rivers was obtained mostly from the two major navigation companies (the *Messageries du Sénégal* of Dakar for the Senegal and the *Société des Messageries Africaines* of Bamako for the Niger), and from "Les Voies Fluviales" in Vol. 2 of *Afrique Occidentale Française* (Encyclopédie Coloniale et Maritime, Paris, 1949).

completed, some of the Niger Valley traffic was diverted from the Bamako-Kayes—St. Louis route to Conakry. The Upper Niger became a part of the hinterland of Conakry; the former dominance of St. Louis was at an end and that of Dakar had not yet begun. Even some of the exports and imports of the Middle Niger moved over the Koulikoro-Bamako rail link to the Upper Niger and then by rail to Conakry.

The First World War delayed completion of the Thiès-Kayes Railway until the end of 1923. With the opening of the complete rail route from Dakar to Bamako, however, the favorable position of Conakry in Niger Valley trade was at an end. The channel between Bamako and Kankan, it will be recalled, is shallow, intermittent, and tedious. Transport had been largely by means of manually propelled river boats and it had become increasingly difficult to obtain the necessary man power. Also, the tortuous railroad over the mountains of French Guinea from Kankan to Conakry was an expensive one to operate and this was reflected in higher rates than on the comparatively straight and level Dakar-Niger line. Accordingly, with the completion of the line to Dakar, all export-import trade of the Middle Niger by way of Conakry ceased. The hinterland of Dakar spread by means of the railway, the Middle Niger, and feeder roads and trails, until it included most of the savanna and sahel (semi-arid) country of interior French West Africa. Bamako, within the hinterland of Dakar, is a railway terminal, river port, and administrative center that has grown much faster than other interior towns and has even forged ahead of the secondary seaports. The present reputation of Bamako recalls that of ancient Timbuktu as the emporium of the western Sudan, with the railway, motor roads, and air lines replacing camel caravans as connections with the outside world.

However, the long interior railway and Bamako are of minor import to the commerce of Dakar, as compared to coastal Senegal and its heavily used branch railways. During the last 50 years the production of peanuts in Senegal has increased until the territory has almost a one-crop economy. Peanuts grow well in the sandy soils of Senegal, and the desirable warm humid atmosphere and summer rainfall of 20 to 50 inches are encountered almost everywhere in coastal Senegal south of St. Louis. The Dakar—St. Louis line serves the peanut area as do the branch lines to Linguere and Touba, constructed in 1928 and 1931, respectively.

Rufisque, a port near Dakar on the south side of Cape Verde (Fig. 5) was formerly important in the export of peanuts, but it has been supplanted by Dakar. On the other hand, Kaolack, on the Saloum River a hundred miles to the southeast of Dakar and Rufisque, increased steadily in importance after the construction of the branch railway to it from the Thiès-Kayes line in 1912. The Saloum River is deep enough for small freighters and Kaolack is closer to certain interior peanut-producing areas than Dakar. Kaolack has become the second port of Senegal, far surpassing St. Louis in tonnage.

The use of peanut oil for cooking and other purposes has increased until it is a serious competitor of olive oil from

TABLE I

EXPORTS OF PEANUTS FROM FRENCH WEST AFRICA

Year	*Metric tons*	*Unshelled*	*Shelled*
1933	397,897	97.7%	2.3%
1936	534,682	76	24
1939	554,586	60	40
1941 (War year)	347,102	1	99

(Computed from tables in *Afrique Occidentale Française, op. cit.*, Vol. 2, pp. 43–44.)

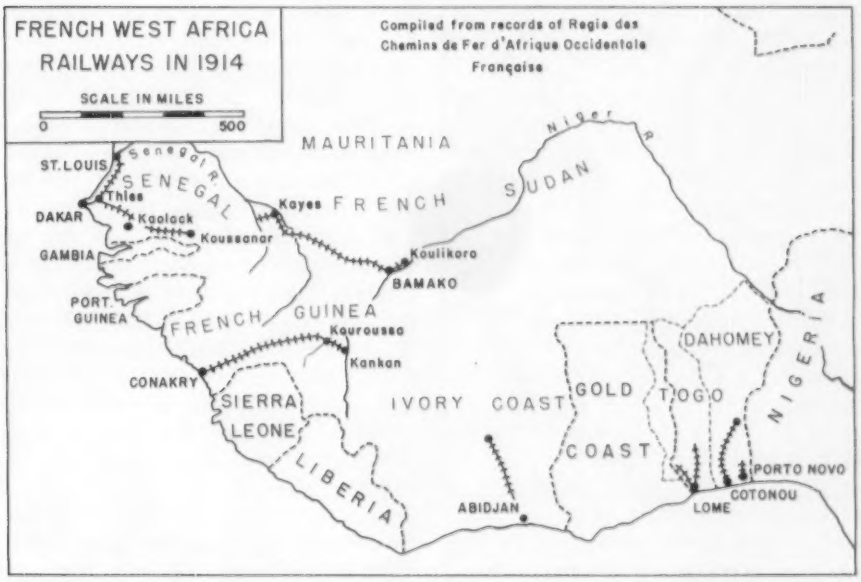

FIG. 6.

the Mediterranean Region. The cost of transport is such an important item that the shipping of unshelled peanuts has given way to local processing which reduces the weight about 30 per cent by eliminating hulls and impurities (Table I).

The change from unshelled to shelled peanuts made possible the exportation of peanuts from more distant regions. Before 1930, Senegal was the only territory in French West Africa that raised peanuts, but, by 1940, other coastal and interior areas had become secondary producers. Political policy and financial support were, of course, of prime importance in the expansion, but the basic factors of ports, railways, distances and cost of transportation were always present. Production is almost entirely restricted to areas near ports or railways.

Before considering the post-war development of Dakar, the history of the other rail lines will be brought up to World War II.

THE CONAKRY-NIGER RAILWAY

The construction of railways in French Guinea was delayed for several reasons. The conquest of the interior was slow and difficult. Britain obtained territory (now part of Sierra Leone) which blocked France from using certain coastal areas for ports and from using favorable interior passageways to the Niger Valley. Several routes were considered before a final choice was made.

The ultimate objective of the railway, the Niger Valley, was reached by a route that runs inland from the coast and then swings to the east behind Sierra Leone, since the British colony lies directly between the headwaters of the Niger and the coast (Fig. 1).

On the coast of French Guinea, as the territory was finally delimited, the best site for a port was the Conakry Peninsula (Fig. 7). This small tongue of land, somewhat protected by islands and a submarine bank at the seaward end, had, however, the disadvantages of

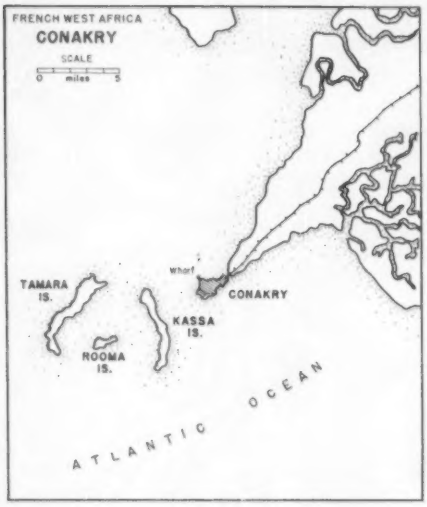

FIG. 7.

shallow water near the shore and a strong longshore current. Conakry became the chief town and port of the colony, despite the necessity for ships to avoid unfavorable wind or tide conditions, and to anchor offshore and discharge by lighters. Only small vessels could use the port. Even in good weather, the currents and distance from anchorage to shore made discharging or loading difficult.

When routes were sought to the Upper Niger, the interior physical geography was also discouraging. French Guinea is composed of a small strip of coastal lowland backed by the high plateaus and mountains of the Futa Jallon. There are no navigable coastal rivers and the central part of the colony is the roughest country in French West Africa.

For French West Africa, the colony of French Guinea has a comparatively dense population and a major purpose of the early railway plans was to provide an outlet for existing interior market centers. Therefore, the Conakry-Niger Railway, commenced in 1900, sometimes followed a difficult course that passed by interior towns, rather than an easier and more direct route. Kindia, about 100 miles inland, was reached in 1904. Four years later the railway, by means of a tortuous route, attained Mamou, a large village in a basin on the plateau at an elevation of 2000 feet. The line was continued across the dissected plateau, reaching Kouroussa on the Upper Niger in 1911 and Kankan on the Milo in 1914. As noted earlier, the Conakry-Niger Railway was the first complete rail link from a seaport to the Niger River, and became a temporary outlet for the Bamako region until completion of the Dakar-Niger line in 1923.

From this time until World War II, however, the port of Conakry and its railway reverted to a place of minor importance. Exports consisted mainly of bananas and palm oil from the coastal zone; no major improvements were made on the harbor; economic progress was slight.

THE ABIDJAN-NIGER RAILWAY

The shores of the Ivory Coast, like those of Senegal and French Guinea, are discouraging ones for ocean transport. The southward facing coast is a gentle concave arc. Along the eastern half the sea has deposited an almost continuous string of sand bars. Behind the bars lie lagoons and swamps into which the rivers pour sediment from the interior plateau. A few streams maintain a channel through the bars to the ocean, but they are shallow and their interior courses are interrupted by rapids or falls where they descend from the plateau. Although there are fewer sand bars along the western part of the coast, the rivers have the same disadvantages of shallow mouths and interior rapids, and there are no lagoons to serve as shelters for barges and small boats. The tide and the almost continual pounding of the strong surf cause

difficulties along the entire coast. There are no natural harbors of even the mediocre class; all are "poor" or "very poor."

For decades ships anchored offshore and unloaded onto boats and rafts which carried the goods to the beach or to unprotected wharfs extending out into the sea. There was not a single place where a ship of even medium size could move close to shore and unload directly onto a pier until after World War II.

Toward the end of the Nineteenth Century a railway was proposed to join the two largest towns, the port of Grand Bassam and the inland center of Kong. The valley of the Camoé River, which passed near both localities, appeared to offer a natural passageway. Investigation, however, revealed some strong objections. The route would run through rough country and dense forest that would add to the difficulty and cost, much of the land was almost uninhabited, the line would lie so near to the eastern frontier that it could serve only a small portion of the colony, and Grand Bassam was a port with a dim future.

By 1902 Abidjan (Fig. 8), on the landward side of a deep lagoon to the west of Grand Bassam, offered the possibility of future development. It was more centrally located on the coast, and the bar separating the lagoon from the open sea could be pierced by a canal, converting the lagoon into an adequate harbor. But obtaining continued financial support for the project and discovering methods of digging the canal and of preventing rapid re-silting were problems that delayed completion for half a century. When the railroad was started northward from Abidjan in 1903, the center was merely a village on a lagoon—a potential rather than actual seaport. The open roadsteads at Grand Bassam and Port Bouet handled ocean shipping.

Railway construction was slow because of the very poor port facilities, precarious financial support, plateau escarpments, tropical forests, and military operations against hostile tribes. By 1912, the line had only reached Bouake. Work was stopped by the World War, but afterward the railway was completed to Bobo-Dioulasso (1934) where the terminal remained until after the Second World War. By the time the last portion was completed the first part was obsolete—grades were too steep and curves too sharp. Between 1929 and 1940 much of the older southern section was rebuilt.

Meanwhile, railway spurs were built to new lighter wharfs along the coast and traffic gradually increased, but it was not until after World War II that

FIG. 8.

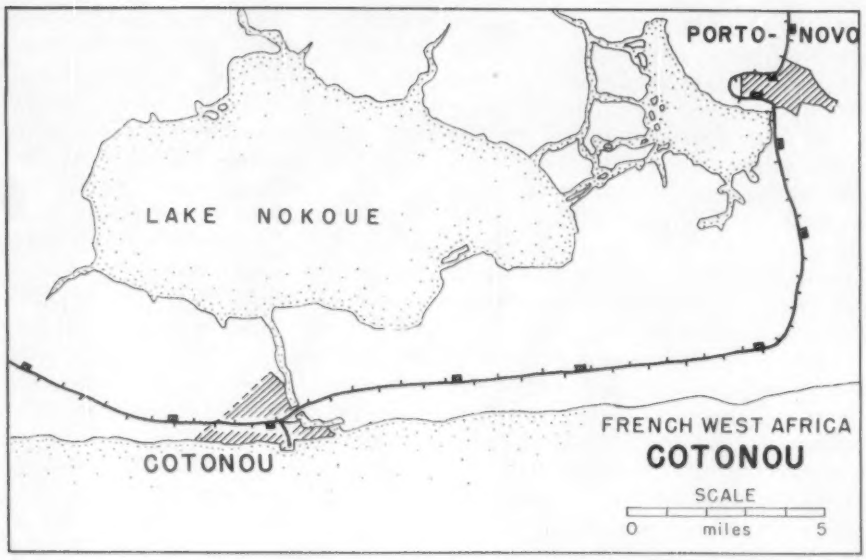

FIG. 9.

Abidjan and its railway jumped to a position of major importance in West Africa.

THE TOGOLAND AND BENIN-NIGER RAILWAYS

French Togo, or Togoland, is not a part of French West Africa and the railways are therefore under a separate administration, but brief mention will be made of the Togoland lines here for purposes of comparison. France acquired a portion of Togo as a mandate when the German colonies were divided after the first World War; the remainder went to Britain.

Germany constructed the major part of the three Togoland lines which radiate from the single seaport of Lomé (Fig. 1). The primary purpose is to serve the coastal areas that produce palm oil and coconuts. In two respects, therefore, the railways of Togoland differ from the lines of A.O.F.; they do not penetrate as far toward the interior and they do not form part of a transportation scheme to help develop the Niger Valley. The Germans, in fact, had planned extensions to the northwest to tap the upper valleys of the Volta River system, which drains southward through the Gold Coast. After World War I, under French control, the central line was extended farther north to provide an outlet for central Togoland, but there are no active plans to extend it further or to combine it with the railways of A.O.F. The gauge is one meter, the same as that of the other French lines of West Africa, but traffic is lighter.

The Benin-Niger Railway of Dahomey, as the name implies, starts at the Gulf of Benin and extends toward the Niger Valley. It has the poorest port of the French West African lines, and reaches little more than half-way toward the Niger River.

Cotonou (Fig. 9) is the sole port among the A.O.F. coastal railheads where ocean-going vessels must still use an open roadstead. The shore with its bars and lagoons generally duplicates

that of the Ivory Coast with one important exception: there is no deep lagoon as at Abidjan. The lakes and rivers between Cotonou and Porto Novo are shallow, and the canal connecting Lake Nokoué with the ocean at Cotonou can be used only at intervals by small vessels when rainfall brings the lake and canal to unusually high levels. For ocean traffic, ships must anchor offshore at Cotonou while boats and lighters carry goods to the wharf.

The central line running northward from Cotonou to Savé (Fig. 3) was constructed by a private company between 1900 and 1912, and completed to Parakou in 1936. The eastern line extending inland from Porto Novo was built by the government between 1905 and 1913 (Fig. 6). The two railways were then joined by a link between Cotonou and Porto Novo and later consolidated as one system.

The completion of a railway from Parakou to the Niger River has been under study but there are no immediate plans for action. In the meantime, a road with truck and bus service fills the gap.

The Dakar-Niger and the Conakry-Niger rail lines reach the Niger and serve longer and more valuable segments than would the proposed extension of the Benin-Niger, and the Abidjan-Niger is being extended to serve the populous Upper Volta Region. The Benin-Niger, in comparison with the other lines, has the disadvantages of poor port facilities and less attractive hinterland. Although towns are growing and economic production is increasing (cotton, peanuts, and shea nuts in the north and coconuts and palm oil in the south) the advances in Dahomey are not as impressive as in the other regions.

[4] Cf. Derwent Whittlesey "Dakar Revisited," *Geogr. Rev.*, Vol. 38, 1948, pp. 626-632.

RECENT DEVELOPMENTS

Since World War II, there has been a great increase in activity at the seaports of Dakar, Conakry, and Abidjan, with an important effect on the associated railways. The growth of the towns is visible in the many new buildings, in the spread of residences into the suburbs, and in the general increase in urban population (Table II).

Dakar benefited during World War II from its strategic location at the westernmost point of West Africa. Other factors have been the increase in peanut production and the climate, which is more bearable to Europeans than at the more humid ports farther south. The rapid change to a metropolitan status has been noted by several writers.[4]

The Port of Dakar has been expanded to three moles on the northern side for special cargoes (peanuts, coal, and fuel oil) and three moles on the southern side for general merchandise and passengers. Numerous railway spurs have been added to serve the port and warehouse district, and the main line from Dakar to Thiès is being double-tracked. The increase in freight handled by the port from 1,280,000 tons in 1946 to more than 3 million tons in recent years is largely accounted for by peanuts moving over the railways. However, Dakar serves not only as an outlet for

TABLE II

POPULATION FIGURES FOR SELECTED CITIES

City	*1926*	*1936*	*1945*	*1955 (Est.)*
Dakar.....	40,000	92,000	132,000	313,900
St. Louis...	18,024	33,100	51,000	60,000
Bamako....	15,633	22,000	37,000	65,506
Conakry....	8,865	13,600	26,000	46,182
Abidjan....	9,126	17,500	46,000	70,000
Cotonou....	6,434	6,500	19,000	26,100

(Figures for 1926, 1936 and 1945 are from *Annuaire Statistique de L'Afrique Occidentale Française*, Imprimerie Nationale, Paris, 1950. Estimates for 1955 are from various local sources.)

Senegal and the French Sudan; it is located at a crossroads of ocean routes almost midway between London and Rio de Janeiro and between New York and Cape Town, and functions as a refueling and resupply station. General merchandise and passenger traffic have shown notable recent increases.

Conakry and French Guinea made only modest progress in exporting palm oil, kola nuts, bananas, coffee, and other agricultural goods until about 1950. Freight handled by the port reached a high of 60,000 tons in 1910 when Conakry was the main rail outlet for the Niger region. There was a decline to 13,000 tons in 1918 (World War I) and then a gradual rise to 184,000 tons in 1938, just before the collapse of World War II. Recovery was made by 1948. Then the construction of a new banana wharf followed by piers for the export of newly opened iron and bauxite mines put Conakry into a new category. All three of the major exports—iron ore, bauxite, and bananas—are obtained from regions near Conakry. The major changes for the railways have been additional spurs for the port and mining areas, and improvements in equipment to handle the increased traffic. In 1953 freight handled by the port exceeded 1 million tons.

At Abidjan the canal connecting the lagoon with the ocean was completed in 1950. Since then several piers have been added and improvements are continuing. In 1955 the port was capable of handling 700,000 tons annually, and traffic may soon exceed a million tons. Many railway spurs have been added in the port area. At the other end of the Abidjan-Niger Railway, the line has just been extended (1955) from Bobo-Dioulasso to Ouagadougou in Upper Volta. This is the longest line added in French West Africa during recent years and the French hope it will aid materially in the development of agriculture in Upper Volta.

TRANSPORTATION AND THE FUTURE

The transportation picture as of 1955 is a mixed one. There is optimism in some quarters because of the port improvements, increased rail traffic, and the rise in exports of agricultural products and minerals; while others point out that the basic problems still remain.

On future port improvements, it should be noted that French policy is to concentrate expenditures on a few ports like Dakar, Conakry, and Abidjan which will handle traffic to foreign areas. These are being provided with large docks, adequate depth, protection from storms, and modern loading equipment, which are necessary for the larger ocean ships of today. Other ports will be maintained only for coastal vessels of shallow draft. For the near future, therefore, one may expect a continued rise of the ports which have made such great gains since the war. Cotonou is a possible addition as a deep-water port.

The future for the railways, especially the inland portions, is difficult to predict. Traffic, it will be recalled, declines greatly toward the interior. Only the coastal areas, as before, have shown great advances in production (peanuts in Senegal, iron ore in Guinea, etc.). The production of cotton and rice is under way on the irrigated projects of the Middle Niger Valley. To date, success has been moderate, but many problems remain for the future. In Upper Volta the railway to Ouagadougou has just been completed and its effects on agriculture and trade are as yet unknown.

There are many plans for additional railways. For example, one proposed line would run inland from Port Etienne, located in Mauritania just south of the Spanish Sahara, to tap the interior deposits of copper and iron. The actual

construction of such a line depends, of course, upon world trade conditions, French politics and finances, and other imponderables. Plans have always been much more numerous than actual construction projects.

Improvements of existing lines, on the other hand, are being made and are likely to continue, especially in coastal areas. All the heavily used sections near the ports are slated for improved roadbeds and additional equipment. A number of fast and light motor driven passenger trains are now in operation between the larger towns near the coast.

Locomotives for the railways of A.O.F. were at first all of steam types, but this led to two problems. The vast savanna lands have a long dry season when water for steam boilers, or for other purposes, is difficult to obtain. Also, the absence of mines makes it necessary to import coal and to transport it to interior depots. Recently, a number of diesel-electric locomotives have been purchased and more are on order for the future. This will solve the railway water problem and reduce the tonnages of fuel shipped to the interior.

French West Africa is heavily dependent upon agricultural exports and many areas have only one or two products, which can meet disaster when world prices or marketing conditions take a turn for the worse. For Senegal and the French Sudan, peanuts and derivatives account for about 90 per cent of the total commerce. In French Guinea, bananas and oil palms furnish about 92 per cent of the agricultural exports. Peanuts and shea nuts total about 80 per cent for Upper Volta. Peanuts alone furnish about 93 per cent of the exports of Niger Territory (mostly by way of British Nigeria), and in Dahomey products of the oil palm total almost 80 per cent. But in the Ivory Coast, with an economy based upon coffee, cacao, lumber, bananas, and oil palms, there is a degree of diversification.[5]

Both the general increase in economic production in the Ivory Coast and the development of new products are often attributed to the stimulating effect of the railway, eventually justifying the improvement of the port of Abidjan. Likewise, railways played a big part in the expansion of peanut production in Senegal, and in the development of Dakar. In French Guinea, since 1953, the export of iron ore and bauxite has been the first case of important mineral exploitation in French West Africa, with close interrelationships with railway and port development.

To a certain extent, the old physical disadvantages of poor natural harbors have been overcome, and the railways to the interior, with improved roadbeds and new equipment, are beginning to take on new life. In the larger towns a start on local manufacturing and processing of agricultural products has been made. It remains for the future to reveal whether the changes since World War II and the rise of Dakar, Conakry, and Abidjan are merely delayed improvements to a feeble production and transport system, or the beginnings of a new era of development.

[5] Figures from *Annuaire Noria: Guide Économique, Afrique Noire Française*, 1954, Société L. Fonque, Oran, Algeria, pp. 25–26.

SOME ASPECTS OF INDUSTRIAL DIVERSIFICATION IN THE UNITED STATES*

Allan Rodgers

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ONE of the major characteristics of industrial development in the United States during the past two decades has been a drive toward diversification of manufacturing in many industrial areas. In part the promotion of diversification has resulted from a belief that industrial specialization was unhealthy, and that specialization has led to the economic and social bankruptcy of communities. A statement from a government publication that appeared in 1937[1] illustrates the extreme nature of this thesis: "A poorly balanced industrial structure throws the entire industrial front out of joint by causing migration of labor, unemployment, lower wages, curtailed purchasing power, less trading business, lower living standards, high cost of relief, high taxes, tax delinquency, untenanted property, stagnation of building enterprises, obsolescence of community plant, and depreciation of industrial equipment." In recent years the emphasis on the need for diversification has assumed, in a few areas, some of the aspects of a search for a panacea for the solution of all local economic problems.

In view of the present importance of diversification policy in the country an understanding of the nature and effects of industrial diversification is essential to effective industrial planning. This paper is primarily concerned with one aspect of this problem, namely, the degree of diversification within the major industrial areas of the United States. It will also report on some results of an analysis of the role of diversification in local economic development.

The Measurement of Industrial Diversification

The term diversification has been used in so many different contexts in the past that more precise definition and measurement is needed. Thus, in its broadest sense, diversification has been defined in the literature as the presence in an area of a great number of different types of industries. Others go further and speak of it as a "balanced" industrial structure, but such a definition is extremely seductive because of the difficulty of defining "balance" in any realistic sense. Finally the term "absolute diversification" has been used to indicate equal employment in all major industrial groups. This definition is relatively meaningless because a measure constructed on such a base would vary tremendously depending on the kinds and numbers of industrial groups measured. For example, can the manufacture of foods be equated with that of furniture; or primary metals with forest products? The problem of definition is further complicated by the fact

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[1] *Our Cities*, National Resources Planning Board, 1937 (Washington, D. C.—1938), p. 62.

that there can be specialization within a major industrial group. Thus, in the case of the leather industry, industrial diversification of a sort might be possible if an area produced a wide variety of styles of shoes for different markets. In this industry, as is true in others, there can be concentration within a specialty, which can be an extreme of specialization.

Another factor of importance in an analysis of diversification is the question of the composition of industry in an area. Thus some industries, especially those classified in the durable goods category such as industrial equipment, are much more sensitive to seasonal and cyclical fluctuations of employment than non-durable goods, particularly the so-called ubiquitous or residentiary industries. Finally, it may be important in the economic health of a community if there is a single establishment in a field or many. With many small firms in an area, failures due to poor management or poor buying and selling practices may be minimized in their over-all effect on the community. On the other hand, the concentration of employment and production in a few larger firms may provide an advantage of local economies of scale which may be decisive in the competitive position of an area.

In sum then with such a wide variety of factors to be considered any measure of diversification that is developed must of necessity be a compromise. It should use a large and varied number of industrial groups as a base and be computed in such a way that deviations are measured from some norm which is considered to be a diversified pattern. If such a measure is derived on a valid statistical base, and its limitations are precisely defined, then it can be an effective tool in an analysis of diversification.

Another aspect of the problem of measurement of diversification is the question of selection of areas for analysis. In this study, standard metropolitan areas were selected as the units for analysis because they are in many ways true functional entities.[2] In studying diversification, employee mobility is of great importance. With modern effective inter and intra city transport, workers can and do live in areas relatively distant from their place of work; therefore, standard metropolitan areas provide a more realistic framework for analysis than the individual cities within the urban complex. Since this paper is concerned with only the major lineaments of the United States industrial pattern, individual smaller cities outside the large urban agglomerations were not studied.

In 1950, the Census delimited 168 standard metropolitan areas; however, many of these cannot be considered important industrial areas, for their employment in manufacturing is extremely small in comparison with total population and limited largely to the so-called ubiquitous industries. Therefore, only those areas were selected for detailed study whose manufactural employment exceeded 20,000. It should be noted, however, that these 93 areas accounted for over 92 per cent of the total manufacturing employment in all standard metropolitan areas, and almost two-thirds of the employment in manufacturing in the United States in 1950. For convenience these 93 standard metropolitan areas are referred to later

[2] Chauncy D. Harris: "A Functional Classification of Cities," *Geogr. Rev.*, Vol. 33, 1943, pp. 86–99, discussed definitively the reasons for the selection of metropolitan districts rather than individual cities in an urban complex for such a study, and for much the same reasons standard metropolitan areas, the successors to metropolitan districts, were used in the investigation presented here.

in this paper as industrial areas.[3] The remaining standard metropolitan areas (those with over 100,000 population) while not analyzed in as great detail were used for limited phases of this study.

THE LITERATURE ON MEASUREMENT OF DIVERSIFICATION

The earliest attempt to measure diversification was that by McLaughlin in 1930.[4] He used Census data on value added by manufacturing and computed the degree of concentration in the five leading industries in 14 cities. Despite the limitations imposed by the restricted sample and the use of a small number of industries this was a significant step forward. Tress, a British economist, contributed another method in a study published in 1938.[5] He used equal employment in 12 major industrial groups as a basis for absolute diversification and computed deviations from this base as indicators of the degree of diversification or specialization of industrial areas.

In 1942, Florence, in his contribution to the industrial location study of the National Resources Planning Board[6] developed a new method for the measurement of diversification. He computed the percentage distribution of employment in all economic activities on a state level and contrasted that pattern with the national economic pattern, using the latter as a frame of reference for a balanced structure. In his method, the various differences between the state percentages and corresponding United States percentages were added, disregarding positive or negative signs. Aside from certain statistical limitations of this measure, the use of the United States pattern as a base is questionable because no area can be a microcosm of the nation as a whole.

In 1949, Reinwald used as his measure of diversification the percentage of total manufactural employment in the leading industry and the two largest industrial groups in various industrial areas in the United States.[7] He also computed a Lorenz index for the five leading industries in these areas. In addition to the limitations imposed by the use of a restricted number of industries, the use of the Lorenz index provided no frame of reference for a diversified structure.

The latest study of this nature was Steigenga's in 1955.[8] Here, the author worked with all economic activities (rather than with manufacturing alone). The relative importance of each of 25 economic branches was measured on the basis of proportion of total employment. Using this distributional pattern, a standard deviation was computed for each area as an indicator of diversity with a high standard deviation indicating a serious lack of diversity and vice versa. This method is subject to the same criticism as those of Tress and Reinwald in that the assumption of perfect diversity is equal employment in all groups. No weights are used, and there is no adequate norm for a diversified structure.

[3] The term "industrial areas" is used here only in a descriptive sense to mean a manufacturing area. It should not be confused with the *industrial areas* formerly used by the United States Bureau of the Census. Note, too, that the term "industrial" is used throughout this paper as synonymous with "manufacturing."

[4] Glenn McLaughlin: "Industrial Diversification in American Cities," *Quarterly Journ. of Econs.*, November, 1930, pp. 131–149.

[5] R. C. Tress: "Unemployment and Diversification of Industry," *The Manchester School*, Volume 9, No. 1, 1938, pp. 140–152.

[6] *Industrial Location and National Resources*, National Resources Planning Board, December, 1942, pp. 120–124, Washington, 1943.

[7] Louis T. Reinwald: *Some Aspects of Statistically Interpreting the Manufacturing Functions of United States Cities*, Unpublished M.A. thesis in geography, Clark University, 1949.

[8] William Steigenga: "A Comparative Analysis and Classification of Netherlands Towns," *Tijdschrift voor Economische en Sociale Geografie*, June–July, 1955, pp. 105–118.

METHOD

The method used in this study is essentially a modification of the measure developed by Tress.[9] In essence the distribution of manufacturing employment by manufacturing group for individual areas is compared with the average distribution for all of the industrial areas studied, with the latter considered a norm or reference level.

The method of computation of the crude diversification index for Indianapolis is shown in Table I. The percentages of employment in 22 manufacturing groups were computed for 93 industrial areas.[10] These percentages were ranked in descending order (Part B); then a series of progressive totals was made (largest group, then largest plus second largest, etc.). Next the progressive totals were summed to arrive at a crude index for the area. Using the 22 manufacturing groups, the crude index for least diversity (for the most specialized area—with a single group employing the entire manufacturing labor force) is 2200 whereas the most diversified area with equal employment in all manufacturing groups would have a crude index of approximately 1500. In the case of Indianapolis the crude index as computed in Table I was 1698.

The final step was the computation of refined indices. This was necessary because the crude indices by themselves give no relative indication of the degree of diversity of an area as they lack a norm or reference level. The base selected was the distribution of employment by manufacturing group for all of the study areas treated as a whole. The crude diversification index for this unit was 1553. The method of computation of the refined indices is as follows:

TABLE I

METHOD OF DETERMINATION OF CRUDE INDEX OF DIVERSIFICATION

EXAMPLE: THE INDIANAPOLIS INDUSTRIAL AREA

Part A

	Employment by manufacturing group	*Per cent of total manufacturing employment*
1. Lumber and wood	831	1.08
2. Furniture	1,085	1.41
3. Stone, clay and glass	1,200	1.56
4. Primary metals	4,092	5.32
5. Fabricated metals	6,256	8.13
6. Machinery except electrical	9,596	12.47
7. Electrical machinery	10,256	13.33
8. Transportation equipment (except motor vehicles and equipment)	4,444	5.78
9. Motor vehicles	7,488	9.73
10. Professional equipment	636	0.83
11. Miscellaneous durable	1,571	2.04
12. Food and kindred	8,712	11.32
13. Tobacco	43	0.06
14. Textiles	1,996	2.59
15. Apparel	1,524	1.98
16. Paper and allied	2,262	2.94
17. Printing and publishing	5,101	6.63
18. Chemical and allied	6,300	8.19
19. Petroleum and coal	424	0.55
20. Rubber	2,210	2.87
21. Leather	173	0.22
22. Not specified	744	0.97
Total	76,945	100.00

Part B

Ranked percentages	*Progressive totals*
13.33	13.33
12.47	25.80
11.32	37.12
9.73	46.85
8.19	55.04
8.13	63.17
6.63	69.80
5.78	75.58
5.32	80.90
2.94	83.84
2.87	86.71
2.59	89.30
2.04	91.34
1.98	93.22
1.56	94.88
1.41	96.29
1.08	97.37
0.97	98.34
0.83	99.17
0.55	99.72
0.22	99.94
0.06	100.00
Crude Diversification Index	1,697.71

[9] The basic modifications lie in the use of a norm for all industrial areas rather than even distribution of employment, and the use of a much larger number of industrial groups as a base.

[10] The 22 groups were based on 1950 U. S. Census of Population, Detailed Characteristics, Table 79, with minor adjustments in terminology. For use of term "industrial areas" see Footnote 3.

Refined Index is equal to *Actual Crude Index* minus *Crude Index for All Industrial Areas* divided by *Crude Index for Least Diversity* minus *Crude Index for All Industrial Areas.* For Indianapolis the refined index $= \frac{1698-1553}{2200-1553} = \frac{145}{647} =$ .224. For convenience the refined index is considered as a whole number, in this case 224.

Refined indices should thus vary from zero with maximum diversity (or the equivalent of the pattern for all industrial areas treated as a unit) to 1000 for least diversity or maximum specialization. In the case of Indianapolis the refined index was 224 or moderate diversity.

It should be noted, as stressed earlier, that this index of diversification has several important limitations. Any index of this nature tends to mask elements in the pattern of individual areas. Thus high indices can result from concentration on one or more industries. In addition, the index gives no indication of the composition of industry in an area, such as employment in the production of durable versus non-durable goods, which, as indicated earlier, may be highly significant in an analysis of diversification.

However, the index does permit an assessment of over-all diversification patterns, allows a comparison of these patterns on an areal base, and provides a statistical basis for the selection of areas to be studied as to the relative

TABLE II

REFINED DIVERSIFICATION INDICES OF AMERICAN INDUSTRIAL AREAS—1950

Philadelphia....039	Shreveport....380	Asheville....612
St. Louis....090	Miami (Fla.)....383	Birmingham....615
Los Angeles....114	Salt Lake City....388	Stockton....617
Boston....118	Houston....393	Rockford....621
Trenton....148	Racine....397	Lowell....624
New Orleans....152	Providence....402	Wichita....629
Cincinnati....167	Albany-Schenectady....403	Evansville....632
New York....173	Oklahoma City....406	South Bend....641
San Francisco....173	Jackson (Miss.)....414	Sacramento....649
Memphis....215	Syracuse....416	Binghamton....651
Dallas....218	Tulsa....417	Galveston....652
Chicago....224	Lexington....420	Canton....655
Indianapolis....224	Duluth-Superior....428	New Britain....655
Atlanta....229	Allentown-Bethlehem-Easton....430	Saginaw....658
Baltimore....235	Richmond....431	Savannah....669
Denver....238	Reading....440	Lorain....677
Buffalo....243	Wilmington....445	Washington....683
Springfield-Holyoke....250	Lincoln....447	Cedar Rapids....683
Kansas City....257	Portland (Me.)....453	Topeka....683
York....261	Chattanooga....456	San Diego....689
Louisville....261	Springfield (Mo.)....456	Sioux City....692
New Haven....274	Seattle....458	Detroit....700
Minneapolis-St. Paul....280	Erie....462	Greensboro-High Point....700
Altoona....295	Hartford....462	Davenport....702
Columbus (Ohio)....298	Phoenix....467	Charleston (W. Va.)....705
Huntington....298	El Paso....474	Youngstown....709
Cleveland....301	Harrisburg....481	Akron....717
Little Rock....301	Brockton....492	Wheeling-Steubenville....726
Jacksonville....303	Rochester....498	Winston-Salem....728
Lancaster....312	Roanoke....505	Johnstown....737
Stamford-Norwalk....320	Austin....505	Fall River....742
Worcester....335	Orlando....564	Lawrence....762
Portland (Ore.)....337	Raleigh....564	Augusta (Ga.)....765
Nashville....351	San Jose....567	Peoria....773
San Antonio....351	Hamilton....569	Baton Rouge....784
Waco....354	Kalamazoo....575	Beaumont....790
Des Moines....355	Tacoma....578	Durham....793
Milwaukee....363	Forth Worth....580	Columbus (Ga.)....794
Bridgeport....369	New Bedford....589	Waterloo....798
Grand Rapids....369	Pittsburgh....600	Lansing....848
Toledo....372	Springfield (Ill.)....603	Greenville....853
Utica-Rome....374	Fort Wayne....606	Flint....934

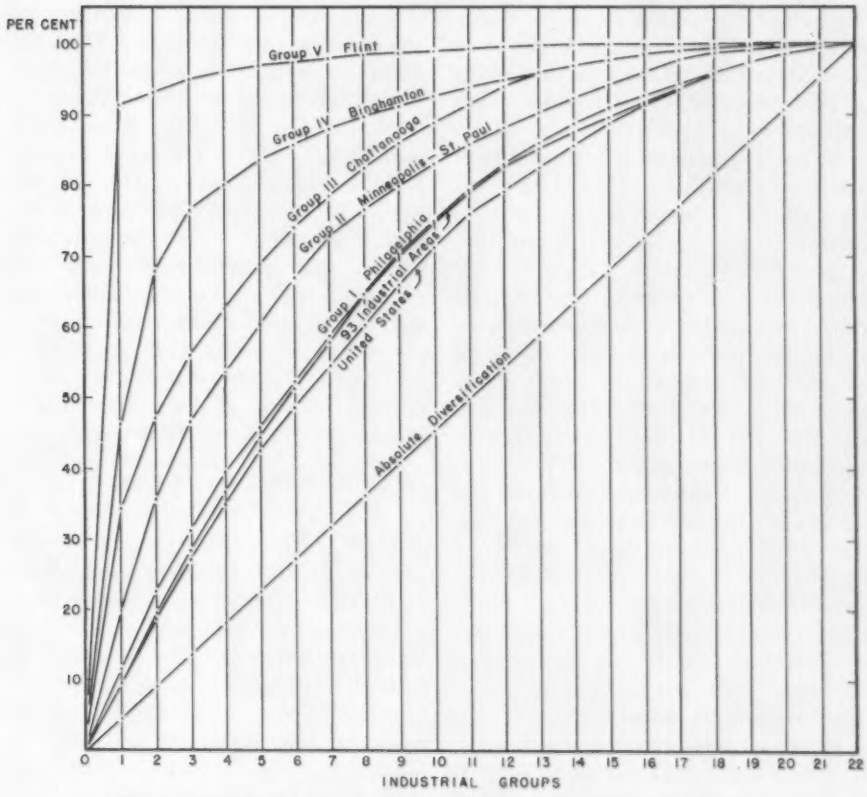


FIG. 1. Graphical representation of typical crude diversification patterns.

effects of diversification versus specialization on local economic development. In addition, the crude diversification indices can be used for the analysis of historical changes in diversification patterns.

ANALYSIS OF DIVERSIFICATION PATTERNS

Using the method previously described, crude and refined indices were computed for the study areas. The refined indices were then analyzed and divided into five broad groups: highly diversified, moderately diversified, intermediate, moderately specialized, and highly specialized. A graphical breakdown of the crude indices is shown in Figure 1. Five curves for what can be considered representative types are compared with the average pattern for the 93 areas, with the pattern for the United States, and with that of absolute diversification, the latter signifying equal distribution of employment in all industrial groups. The Flint area proved to be the most specialized and the Philadelphia area most closely approached the average pattern for the study regions.

Since the index varied from 39 for the Philadelphia area to 934 for Flint, the question can then be asked: To what factors can the variation in the size of the index be attributed? One of the factors that seemed most relevant was

the size of the population of the industrial area, on the assumption that as an area increases in size its industrial pattern becomes more diversified. The two series were tested for correlation with a resulting coefficient of curvilinear correlation of rho = .552. Using rho squared as a quantitative basis of interpretation, the result indicates that roughly one-third of the variation in the indices of diversification can be associated with the size of the industrial area. A further analysis of some fifty-odd smaller and less industrialized centers indicated rather conclusively that specialization is more pronounced with decreasing size of center.

Similarly, a comparison between the indices of diversification and the proportion of the labor force engaged in manufacturing yielded a coefficient of linear correlation of r = .372. While this proved to be statistically significant, in practical terms this factor was obviously only one of a number of possible elements in the pattern.

The data were then mapped to see if any significant regional variations in diversification were observable. The results are shown in Figure 2. Although the map is rather complex it is certainly evident that none of the so-called broad regions of the country stand out as either regions of diversification or specialization. However, there are significant elements in the pattern. The only important continuous region of diversification that is evident is the large urban agglomeration of the Atlantic Seaboard from Baltimore to New York. Here the factor of size of the individual industrial areas appears to be of critical importance. Several broad areas of specialization are apparent, the most important being the basic steel area of eastern Ohio and western Pennsylvania, and the other, the motor vehicle production center of southeastern Michigan. Aside from these rather obvious regions, the patterns are complex. Thus the South is an area of admixture as are New England and the Middle West.

Another element in the pattern which is evident is the fact that, in the less highly industrialized sections of the nation, the regional metropolises are highly diversified. These large market centers serve broad tributary areas and produce a wide variety of products both for sale within the standard metropolitan areas themselves as well as in their hinterlands. Such areas would include Atlanta, Dallas, Kansas City, Minneapolis–St. Paul, and Denver.

HISTORICAL CHANGES IN DIVERSIFICATION PATTERNS

Turning to another aspect of the problem of diversification, there is the rather important question whether there is a tendency toward local diversification as an area matures. In an attempt to answer this question, crude diversification indices were computed for 90 study areas for 1940 and 1950, using the 16 industrial groups for which data were available. The changes computed varied from a maximum increase of 103 points in the index or a movement toward specialization, to a maximum decrease in the index of 117 points or diversification. Although the short time-period involved is an obvious limitation in the utility of these materials, the differences proved to be statistically significant.

Of the 90 areas studied, roughly half showed significant diversification during the ten-year interval, and one-third showed significant specialization. It is also important to note that of the areas that tended toward specialization during this period, more than one-third were rated as highly diversified in 1950. In general, then, there was a significant tendency toward diversification in the

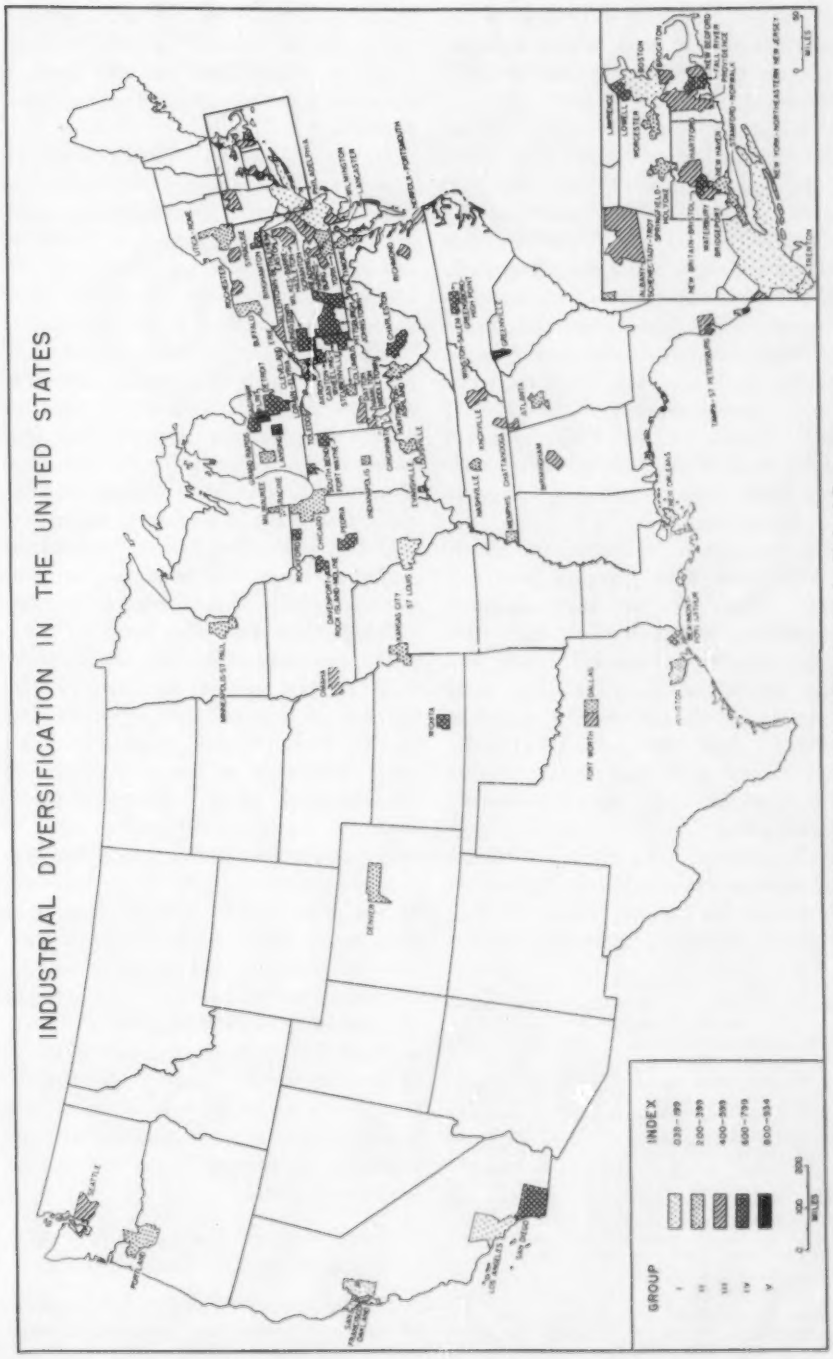


FIG. 2. Industrial diversification in the United States.

study areas. An analysis of 1930 industrial employment data, which unfortunately are very limited in their utility,[11] indicates the same basic trend. A study of changes in crude diversification indices for the United States as a whole for the years 1919, 1929, 1940, and 1950 shown in Table III indicates that the national manufacturing pattern has undergone a slight trend toward specialization during this period. The implications of these data, plus the aforementioned changes in the areal indices, are that there has been some tendency toward specialization in the smaller urban centers of the United States. Further studies would have to be made along these lines to prove or disprove this assumption.

The changes in the indices from 1940 to 1950 were then grouped into five major classes: major diversification, moderate diversification, no significant change, moderate specialization, and major specialization. The data were then mapped; the patterns are shown in Figure 3. Again the patterns are relatively complex, though much simpler than those on the map of industrial diversification.

It is apparent that there have been marked regional variations in diversification during this period. Thus the Middle West exhibited tendencies toward specialization, while the Southeast and the industrial triangle of eastern Ohio, northern West Virginia, and western Pennsylvania showed significant diversification.

TABLE III

HISTORICAL CHANGES IN CRUDE DIVERSIFICATION INDICES FOR THE UNITED STATES*

Year	*Crude diversification indices*
1919	1.385
1929	1.398
1939	1.406
1950	1.409

*Computed from the *U. S. Census of Manufactures*—1919, 1929, 1939, various pages; and the *Annual Survey of Manufactures*, 1952, Washington, 1953, pp. 14–15.

[11] Employment data by industrial groups are given in the 1930 Census of Population, but the industrial groups vary, depending upon the importance of each industry in the specific state.

In the case of the Middle West, an analysis of the changing manufacturing composition patterns indicated a much greater emphasis on various types of machinery, metal fabrication, and the motor vehicle industry. Southern industrial centers showed a relative decline in the importance of such traditionally dominant industries as textiles, tobacco, and food products, with increased stress on forest products, apparel, and machinery. The emphasis in the Industrial Triangle, which also diversified, has shifted to some degree from basic iron and steel production to metal fabrication and machinery. The remaining patterns are more complex, and space limitations preclude their discussion here.

In sum, then, it is evident that there exist marked regional variations in the pattern of industrial diversification in this country. In part, these variations are attributable to the varying size of the industrial areas studies, but many other factors presumably play roles in this pattern; among them, location is of major significance. Although, because of the absence of adequate long-term comparable data, no definitive answer can be given to the question of the effects of time on diversification, during the period from 1940 to 1950 there was a tendency toward diversification in these study areas. However, here again, there were striking regional variations in this pattern with specialization trends exhibited in several important manufacturing regions.

THE ROLE OF DIVERSIFICATION IN LOCAL ECONOMIC DEVELOPMENT

During one period in the development of Western economic thought, it was

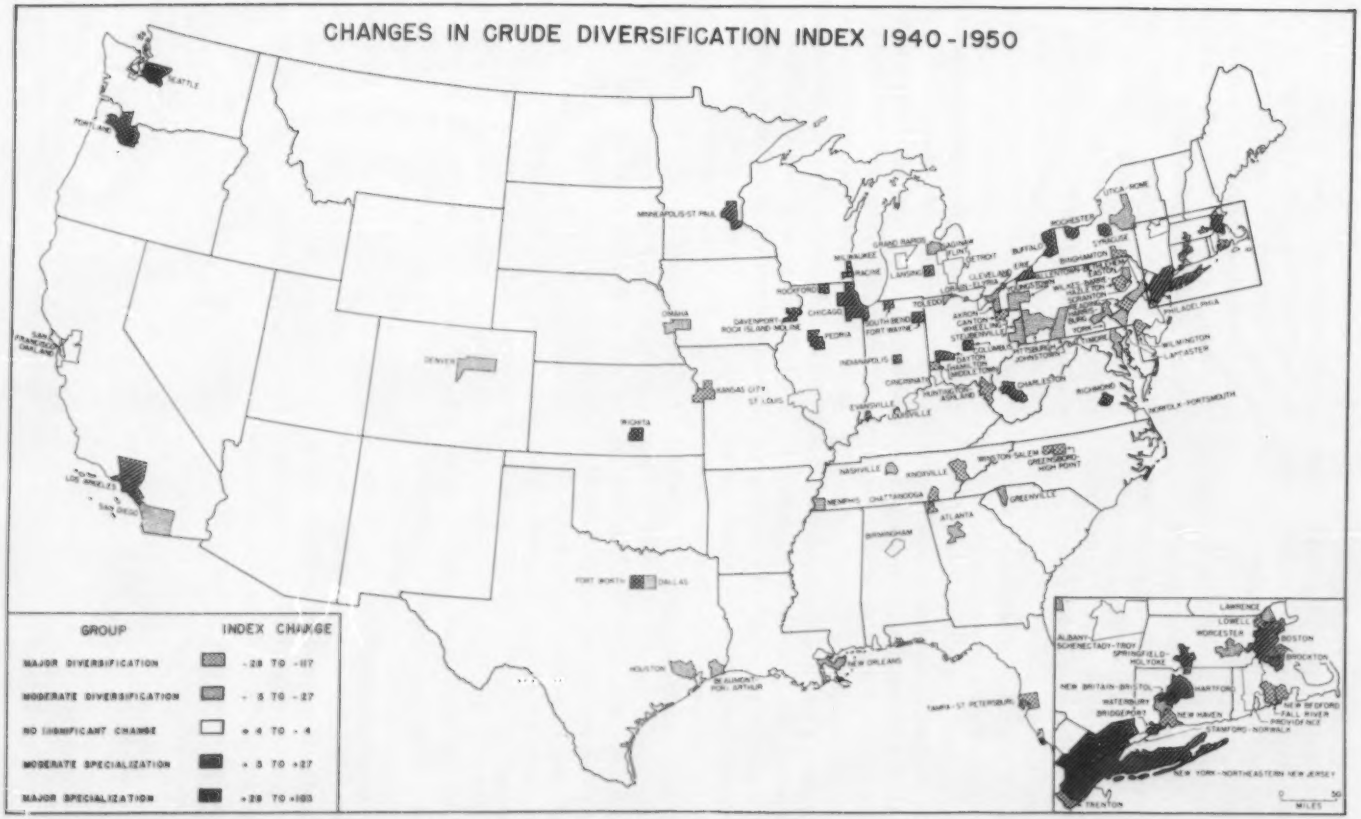


FIG. 3. Changes in crude diversification indices, 1940–1950.

believed that specialization was the key to economic growth. The thesis, stated in simple terms was: specialization means the most efficient use and distribution of productive resources to satisfy demand, the economical use of highly specialized and expensive machinery, and the building of a constant local market for hereditary and specialized skills—all of which would result in the highest possible standard of living.[12]

However, with the advent of the disastrous economic depression of the thirties, both here and abroad, there came the realization that some highly specialized areas were extremely vulnerable to cyclical and secular variability of production and employment. Thus there resulted a turn to diversification as a solution for the economic problems of these areas. This emphasis on diversification as a locational policy had its greatest expression in Great Britain.[13] Here, a study of the so-called depressed areas resulted in recommendations that diversification should be a fundamental government policy in improving economic conditions in these areas. To some degree, the same basic ideas appear to have taken root in this country.

With the passage of time it has become almost axiomatic to consider diversification as essentially synonymous with economic well-being in an industrial area. The economic advantages of diversification have been most effectively analyzed by Hoover.[14] In summary form they can be stated as: the stabilization of employment and income through compensation of seasonal and cyclical fluctuations, easier replacement of declining industries, and fuller use of complimentary groups in the labor force.

Although it is extremely difficult, on a broad base, to measure accurately the effects of diversification on the economic health of an area, on the basis of the above axiom there should be a strong positive correlation between the degree of diversification and indicators of economic stability. To test the validity of this statement an analysis was made of the relationship between seasonal and annual employment fluctuations by industrial area and the comparable indices of diversification. It should, of course, be stressed here that any relationships that were derived are subject to the limitations of the diversification indices themselves discussed previously.

SEASONAL VARIATION

While no long-term monthly employment data have been collected for most of the industrial areas of the United States, the Bureau of Labor Statistics has compiled such materials on a partial basis since 1947. Currently, data is received and published for 114 areas. For the purpose of this study unpublished statistics were used on manufactural employment for 82 industrial areas for the period 1949–1954.[15] These data were analyzed for seasonal variation using the method of moving averages which eliminates cyclical and irregular movements. Average deviations of the

[12] Alfred Marshall: *Principles of Economics*, 8th edition, 1920, pp. 271 and 278. Marshall also recognized the disadvantages of specialization in terms of liability to extreme depression; see, especially, page 272 of the same work.

[13] *Report of the Royal Commission on the Distribution of the Industrial Population of Great Britain* (Barlow Report), London, 1940, various pages. See also: Political and Economic Planning, *Report on the Location of Industry in Great Britain*, London, 1939.

[14] Edgar Hoover: *The Location of Economic Activity*, New York, 1948, page 285. Hoover also wrote a detailed report on *Diversification as a Locational Policy*. Unpublished Memorandum, National Resources Planning Board, May, 1941, available at National Archives, Washington, D. C. This study effectively details both the advantages and pitfalls of the diversification policy.

[15] Unpublished data provided by the Division of Manpower and Employment Statistics of the Bureau of Labor Statistics, Washington, D. C.

seasonal indices were then computed for each area with variations ranging from a maximum of 218 points (out of 1000) to a minimum of eight points. It should be noted that remarkably little seasonal variation existed during this period, and it is probable that if data were available for the 1930's, for example, much greater variation would be found to be present. The deviations were correlated with the refined indices of diversification for the corresponding areas with a resulting coefficient of linear correlation of .243 ($r^2 = .0593$). This slight positive correlation indicates that during this period there was no significant association between diversification and seasonal variation in industrial employment. The data were then mapped, and the resulting patterns are shown in Figure 4. (In Figure 4, group I represents less than average variation, average deviation 8–16; group II, greater than average variation, average deviation 17–48; group III, major variation, average deviation 111–218.) The only broad areas of appreciable variation (greater than the median) were found in the West and South, or in those regions which had a relatively large percentage of total manufactural employment in the canning, freezing, drying, and packaging of food products.

As a supplementary test of the relationship between diversification and seasonal variability of employment, data were computed from the Census of Population, 1950[16], for 144 industrial areas for the average number of weeks worked during 1949 by workers engaged in manufacturing. These data were correlated with the crude indices of diversification for the same areas with a resulting coefficient of linear correlation of .116 ($r^2 = .0135$). Here again no significant relationship appeared to exist.[17] In sum, then, in recent years no significant correlation has existed between diversification and seasonal variability of industrial employment.

[16] Data for 55 of these areas were published in the various state volumes of the U. S. Census of Population, 1950. The data for the remaining areas were computed from unpublished statistics furnished the writer by the Population Division, U. S. Bureau of the Census, Washington, D. C.

CYCLICAL VARIATION

Long-term annual industrial employment data are still not available by industrial areas in the United States. However, reliable annual statistics do exist by county and city from 1926 on for the state of Pennsylvania. Since the industrial areas used in this study are based on single counties or groups of counties, it was possible to compute variability of employment for a small but highly varied sample of 12 industrial areas from 1926 to 1950. The data were converted to a base of 1000 with 1926 as the base year, and standard deviations were then computed for each area. The resulting deviations and corresponding crude indices of diversification for 1940 are shown in Table IV.

The above data were tested for correlation, and the resulting coefficient of linear correlation was found to be .223 ($r^2 = .0545$). Again the relationship proved to be statistically insignificant; the diversified areas were no more stable than the specialized ones.

In connection with this analysis it has been postulated that "Wide diversification probably precludes high rates of growth—an area dependent on one industry may experience rapid or slow growth, whereas an area with a large number of one or less equally important

[17] In addition to these materials, a compilation was made of data on the average number of months worked in 1939, by city, from the U. S. Census of Population, 1940, various pages. Unfortunately, these statistics were only available for a biased sample—cities with over 250,000 population. Even here, the resulting coefficient of linear correlation was only .370 ($r^2 = .1356$).

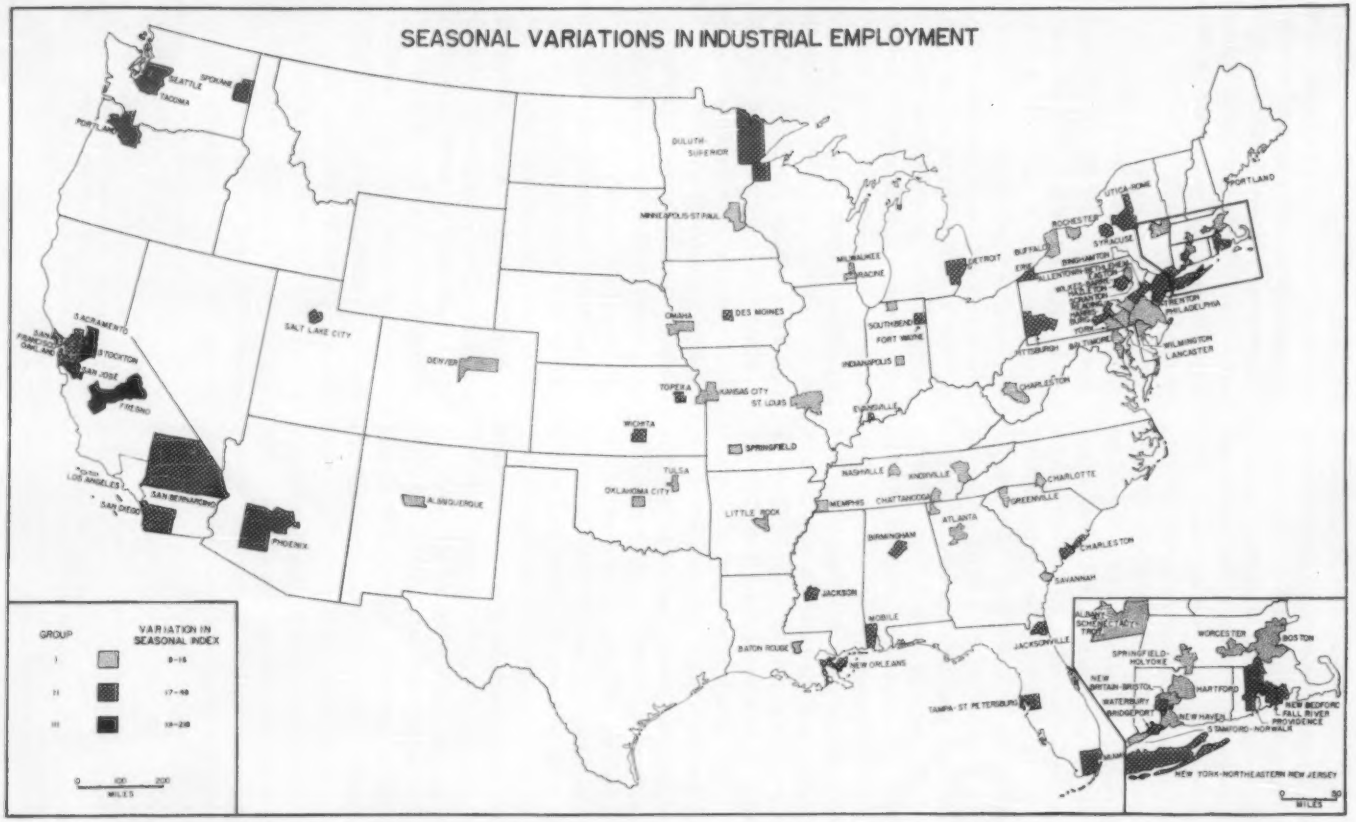


FIG. 4. Seasonal variation in industrial employment in the United States, 1949–1954.

industries is very unlikely to experience either very rapid or very slow growth."[18] To test this assumption an analysis was made of the percentage change in industrial employment for 76 industrial areas for the years 1919–1929–1939–1947. These data were compared with the crude indices of diversification for 1940. Here again the assumption proved invalid, for diversified areas in many cases experienced more rapid rates of growth than specialized regions and no set pattern could be observed. The over-all percentage change in employment for the 28-year period was then correlated with the diversification indices, producing a coefficient of linear correlation of .0574 ($r^2 = .0033$).

At this point it must be emphasized that the above correlations cannot be considered conclusive because they are, for the most part, based on limited data. Long-term reliable statistics do not exist on a monthly basis by industrial area, so that really valid tests cannot be made of the relationship of seasonal variation and diversification in the major industrial areas of the United States.[19] Nevertheless, it is believed that these materials do indicate rather conclusively that no blanket assumptions can be made of any strict relationship between economic stability and diversification as measured solely by the compositional spread of industry in an area.

CONCLUSIONS

What is needed, then, for effective industrial planning is an over-all evaluation of the economic structure of industrial areas. In such an evaluation, the index of diversification is a useful tool, but it must be used in conjunction with other measures of the economic well-being of an area. In addition to measurement of the diversity of the industrial complex, there must also be analyses of the character of the individual industries with respect to the size of firms,[20] degree of sensitivity to cyclical fluctuations, seasonal variability of employment, types of labor employed, etc. Specialization is not of itself necessarily unhealthy; however, if an area is highly specialized it is extremely important to know whether the specialized industry is sound or declining and what its prospects are.[21] Above all, in any industrial development program, new industries should be chosen on a selective basis

TABLE IV

ANNUAL VARIABILITY OF INDUSTRIAL EMPLOYMENT AND CRUDE INDICES OF DIVERSIFICATION FOR PENNSYLVANIA INDUSTRIAL AREAS

Area	*Crude indices of diversification—1940*	*Standard deviations of annual employment—1926–1950**
Philadelphia**	1,153	2,117
York	1,223	1,731
Altoona	1,268	3,190
Lancaster	1,306	2,240
Allentown-Bethlehem-Easton***	1,332	2,343
Harrisburg	1,340	1,981
Wilkes Barre–Hazelton	1,370	2,373
Scranton	1,384	3,167
Reading	1,406	1,137
Erie	1,412	4,437
Pittsburgh	1,454	2,503
Johnstown	1,476	2,527

*Computed from various volumes of the *Report on Productive Industries, Public Utilities and Miscellaneous Statistics*, Department of Internal Affairs, Harrisburg, Pa.
**Without Burlington, Camden, and Gloucester Counties, New Jersey.
***Without Warren County, New Jersey.

[18] Glenn McLaughlin: *Growth of American Manufacturing Areas*, 1938, p. 226.

[19] These area data are now being collected and should provide the basis for extremely valuable studies in the future.

[20] See *Small Business and Civic Welfare*, U. S. Senate Document 135, 79th Congress, 2nd Session, February, 1946, for an analysis of the role of big and small business in community development.

[21] Homer Hoyt: *The Economic Base of the Brockton, Massachusetts, Area*, January, 1949, discusses a highly specialized shoe manufacturing center whose basic industry faces serious economic problems.

with regard to their economic and social feasibility in the area.[22]

PROBLEMS FOR FURTHER RESEARCH

Further investigation of some of the aspects of this paper is certainly needed. Some of these problems can be summarized in question form. Are there more sensitive measures of diversification that can be used which would reveal more of the industrial composition of individual areas, particularly with regard to their emphasis on cyclically sensitive industries? Would diversification indices for "basic" industries be of greater value than a measure based on the total industrial complex? Is there any direct measurable relationship between diversification and employment in urban service activities? What are the effects of diversification on intraregional income differences?

In particular we need to know more about the relative effects of diversification versus specialization on individual industrial areas.[23] Thus it might be possible quantitatively to measure these effects in terms of community costs for service to industry and industrial workers in relation to community income from these sources. It should also be possible, working on a detailed sample base, to arrive at some definite conclusions as to the effects of time on diversification patterns and the implications of these changes.

[22] The Area Development Division of the U. S. Department of Commerce has provided a great deal of information on planned industrial development through its publications. Among them one that is most pertinent here is *Suggestions for Diversifying Industry in Your Community*, U. S. Department of Commerce, Regional Office, San Francisco, California, 1948.

[23] Robert Gold in his study, *Manufacturing Structure and Pattern of the South Bend–Mishawaka Area*, University of Chicago, Department of Geography, Research Paper No. 36, Chapter IV, pp. 67–105, has made some valuable contributions along these lines for the area he worked with.

THE INTENSIFICATION OF FINNISH FARMING

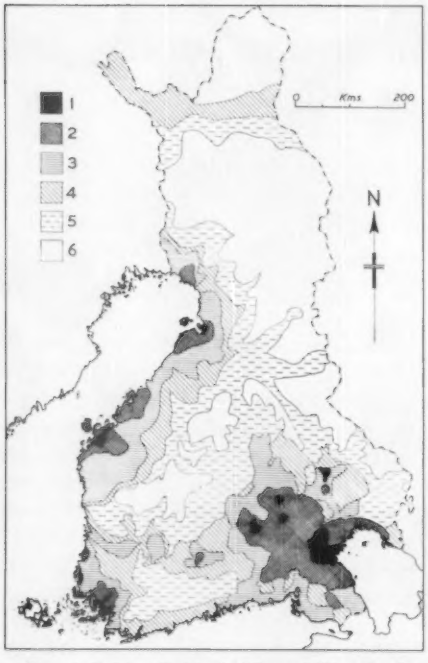
S. Jaatinen and W. R. Mead

Dr. Jaatinen, Docent in the Geographical Institute of the University of Helsinki, is the author of "Bidrag till Kännedomen om de Alandska Sjöarnas Strandvegetation," Helsingfors, 1950. Dr. Mead, Reader in Geography in the University of London, is the author of "Farming in Finland," published in London in 1953.

THE forest is the beginning and the end of economic life in Finland. But before Finland began to live off timber—with the late nineteenth century transformation of softwood values—it had to live off the land. Moreover, when it ceases to live off timber—for example, when war obstructs its vital channels of trade—it must continue to live off the land. If few countries are so aware of the importance of their timber, few are so conscious of the significance of their farmland. In view of its high latitude it is remarkable that Finland devotes so much energy to farming and derives such a significant part of its national income from it. Farming is everywhere set within the frame of the forest, and forestry is almost everywhere integrated with farming practice. Farm land has been won historically and is reclaimed contemporarily from the woodland. The revaluation of timber and re-assessment of agriculture have encouraged a new approach to rural resources. Forestry and farming—always complementary—now become increasingly competitive. And the competition results from the growing intensification of activity in each pursuit.

An economic geographer observing this intensification is likely to see it in terms of maps. It is appropriate that the forest as the beginning of economic life in Finland should be the subject of the first significant resource map of Finland. This was the forest map of the land survey director C. W. Gylden, published just over a century ago. It is reproduced as Figure 1 and shows his qualitative assessment of Finland's forests. Two main areas of softwood exhaustion stand out—the northwestern coastlands (Ostrobothnia), the pitch and tar region; and the southeastern territory of Karelia, where woodland burning for farming purposes was most widespread. The agricultural resources of Finland—assessed experimentally in the unpublished statistics of C. C. Böcker in the 1830's—were not expressed cartographically until I. J. Inberg's *Suomenmaa kartasto* (Helsinki, 1878). Since then, an appreciable tradition of map making has run side by side with the publication of agricultural censuses. Both the first and second *Atlases of Finland* (1899, 1910) gave generous space to agricultural maps. Hannes Gebhard, the great protagonist of farm co-operation, in addition to sponsoring the first significantly reliable rural census also championed maps through rural reports such as his *Socialstatistik Atlas*.

It is a far cry from these earlier assessments to the great national stock takings which have been conducted in Finland at the turn of this half century. The 1951 agricultural census (Helsinki, 1954) has not merely followed in the footsteps



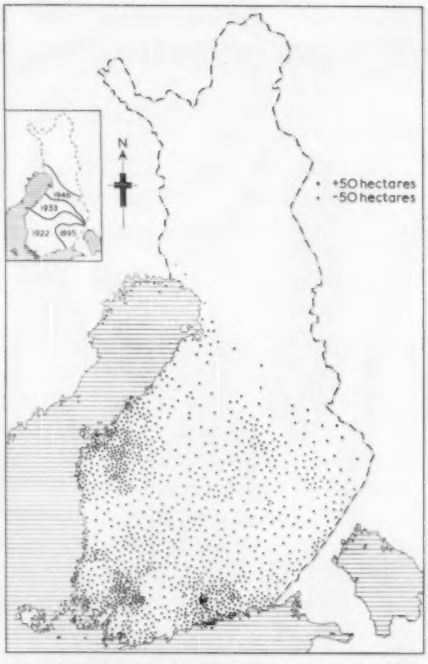


FIG. 1 (left). Gylden's Map of Woodlands, 1850. The following is a literal translation of his six categories: 1. General shortage; 2. Scanty fuel and small timber, shortage of large timber; 3. Sufficient fuel and small timber, shortage of large timber; 4. Sufficient fuel and small timber, scanty large timber; 5. Appreciable surplus of fuel and small building timber, sufficient large timber; 6. Surplus of wood.

FIG. 2 (right). Changes in spring wheat acreage between 1941–1950 (Source: *The Official Statistics of Finland* III; *The 1941 Census of Agriculture* 38, 3, Helsinki, 1948; *The 1950 Census of Agriculture*, II, Helsinki, 1954; inset map: the limits of spring wheat cultivation at different times).

of its decennial predecessors, but has also been undertaken in conformity with F.A.O. proposals. International comparison therefore becomes easier; though intercensal changes in the data collected may lead to unconformity with earlier domestic returns. The third forest survey, undertaken between 1951–53 and published in a preliminary statement (*Metsäntutkimuslaitoksen julkaisuja*, 43,4, Helsinki, 1954), must surely make Finland's timber resources the best understood of any in the world. The 1950 population census (Helsinki, 1952) has been the subject of initial geographical analysis by H. Smeds. Meanwhile, a large-scale aerial survey of Finland gives to its mapmakers for the first time a means of seeing the entire country in a new perspective.

From this body of raw material, light may be cast upon three changes which have been proceeding simultaneously in post-war Finland. The changes proceed at different speeds. The most rapid and most remarkable has been the social change resulting from the resettlement of 450,000 displaced people. Technical change has proceeded more swiftly as the country has adjusted itself to this social upheaval. Biological change, the slowest but most fundamental of the three, has continued uninterruptedly beside them. Each of these three types of change has made its contribution to the agricultural

landscape, a contribution which amounts collectively to a genuine agrarian revolution for mid-twentieth century Finland.

CHANGES IN BIOLOGICAL CONDITIONS

"Finland lies upon the margin of the so-called zone of agriculture," wrote a contributor to *Wiborg Tidning* in 1856; it is correspondingly sensitive to any changes brought about by experiment into the growth conditions of plants. It is a country which, from the point of view of food and fodder production, has lived on the famine fringe of Europe. In this connection the incidence of summer frosts has been almost as important as the shortness of the growing season. Finland's grain production has been highly variable in relation to consumer needs. Southwest Finland has been in the past a region of grain export—to Sweden, as *The Times* was telling English readers in 1808. In more recent decades, Finland has been a grain-importing country—especially from the U.S.S.R. Plant breeding has had its most spectacular results in the picture of grain production—reducing relative dependence on outside supplies, smoothing out many regional differences in domestic production, and bringing about primary changes in the types of grain grown. No single grain has shown a more striking change in distribution during the last generation than spring wheat. The principal parent grain behind the change has been *Diamond*, a seed wheat bred at Svalöv, subsequently refined at its native plant station and married with Finnish varieties. So successful has *Diamond* been that it is difficult to persuade growers that it has been succeeded by superior varieties. Figure 2 shows the expansion of spring wheat cultivation between 1940–51. Its inset map shows the frontier of spring wheat cultivation in Finland as presented by the three successive *Atlases of Finland* and the latest statistics. An accompanying social change is the swing from "black" to white bread consumption.

Although spring wheat announces itself as a new crop in north Finland, it advertises itself less boldly than the vivid yellow flowers of the new turnip rape (1953: 17,300 hectares). A number of rape seeds have been bred in Finland. Besides adding variety to the climatically limited number of crops, they offer a cleansing crop in the rotation system, a direct or indirect source of fodder and, through their seeds, a refinable oil for margarine.

Less striking, but of perhaps more profound importance, are the improvements in indigenous grass strains and temporary grass mixtures. For, in the final place, fodder crops are likely to be of greater moment for Finland than crops directly oriented to human consumption. Every biological victory in the establishment of a more persistent and more resilient grass sward is a step towards independence in fodder production. In this connection, too, new methods of fodder conservation give rise to superior concentrates. The biological investigations of A. I. Virtanen have transformed the fodder regime on many Finnish farms which now employ his chemical method of ensiling.

A third aspect of biological change is the emphasis placed on artificial fertilizers, for natural manures are insufficient to maintain the present Finnish farm output. Already, before the war, the results of artificial fertilizers on Finland's farm land were evident. The war years, during which Finland was cut off from major sources of outside supply, witnessed a sharp decline in productivity and a large percentage of this decline is ascribed to soil exhaustion. The price of arti-

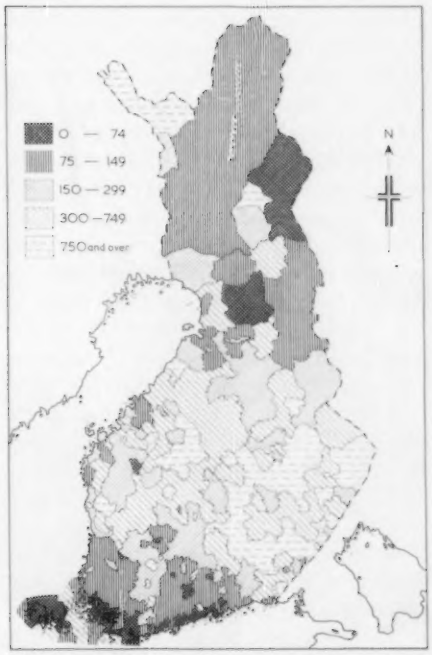
ficial fertilizers has been heavily subsidized in recent years. Their position in the forefront of Finnish considerations is evident from the attention given to them in the agricultural statistics. Unfortunately, these do not lend themselves to comparative treatment in detail. However, four times as much nitrogen and potash fertilizers and nearly three times as much phosphoric acid and lime are used as before the war. Dependence upon imports has encouraged the establishment of fertilizer factories in Oulu (nitrates and ammonia) and Kotka (phosphates); but more than three-quarters of Finland's needs derive from outside sources. Raw materials limitations, moreover, must prevent any very considerable substitution from home production.

The ultimate consequence of these biological improvements and of parallel developments in the increasing animal stocks is a better yield per hectare of land.

CHANGES IN THE TECHNICAL SITUATION

The mechanization of Finnish farming has been slow and pre-war censuses reveal a general absence of mechanical aids. Almost equally noticeable has been the small number of lorries, trucks, and private cars owned by farmers; although the available fleets of co-operative society vehicles must not be overlooked. Many reasons account for the delayed development—the more urgent demands of other outlets for farm capital, the availability of cheap farm labor in a country where agricultural employment still took precedence over industrial employment as recently as 1940, the limited domestic production of equipment, and the diversion of national capital resources into industry rather than agriculture.

As in most European countries, the multiplication of tractors is the most common form of mechanization. In considering the impact of the tractor in post-war Finland both the scale of farm operations and the size of the tractor must be remembered. Finland is a country of relatively small properties and, frequently, of relatively small units of tillable land. The extent of the land farmed must therefore be constantly balanced against the cost of the tractor. Secondly, the period of employment of a tractor, with a long closed agricultural season, must not be overlooked. Winter employment possibilities for a tractor are limited: it is not, for example, substitutable for a horse in forestry. A growing range of tractor sizes reduces some obstacles to their purchase. Heavy American tractors are in some respects ideal for land clearance and for opening up new highways; though their maneuverability is restricted by the equinoctial mud, the winter snow, and the softness of the peatlands (so much the object of reclamation). They are not generally bought by private farmers. The establishment of state-sponsored (but privately operated) machine and tractor units has been of great consequence in the period of post-war resettlement; but co-operative tractor and machine pools have not been a success. The multiplication of tractors in Finland has been tied to the appearance on the market of smaller, cheaper, and more maneuverable models. The rise of a tractor assembly industry in Finland itself is a reflection of the success of and demand for this type of machine. The small, privately-owned tractor therefore coexists with the large company-owned unit, each fulfilling a distinct purpose in the mechanization of rural activity. The density of tractors, with social prestige as well as rural economics forcing steady multiplication, is shown



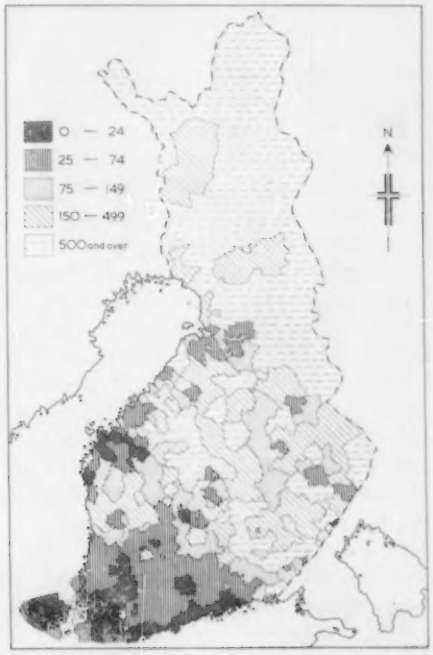


FIG. 3 (left). Relative density of tractors, 1950. The figures express on a parish basis the area of arable land (in hectares) per tractor (Source: *The 1950 Census of Agriculture*, II, IV, Helsinki, 1954).

FIG. 4 (right). Relative density of grain harvesters. The figures, which are on a parish basis, express the area of cereals (in hectares) for each harvester, 1950. (Source: *The 1950 Census of Agriculture*, II, IV, Helsinki, 1954.)

on a distributional basis in Figure 3. There are approximately 30,000 tractors today.

A second mechanical aid introduced to the country scene is the grain harvester (Fig. 4). Increased grain production, increased cereal acreage, diminished labor supply, increased wages—and the production of smaller, cheaper and more appropriate harvesters—have encouraged their multiplication. In one respect, the countryside is not ripe for tractor and harvester. It is still seamed with open ditches, so that the aerial view of the cultivated land gives the illusion of open-field strip holding. The "enclosure" of the ditches, implying heavy investment in deep drainage, is a requirement of over nine-tenths of Finland's agricultural land. This would remove an obstacle to the manipulation of machines in the field. Boulder clearance also remains a prerequisite for mechanization over another 175,000 hectares.

Machines, of course, may be employed in animal husbandry as well as in field husbandry. The traditional emphasis upon dairying has encouraged an increasing number of milking machines (1953: 16,000); though the size of the herd (50 per cent of the machines are on farms with less than ten dairy cows) and the availability of power (50 per cent of the farms of more than two hectares are still not supplied) set limits. Figure 5 shows the distribution of machines per cow.

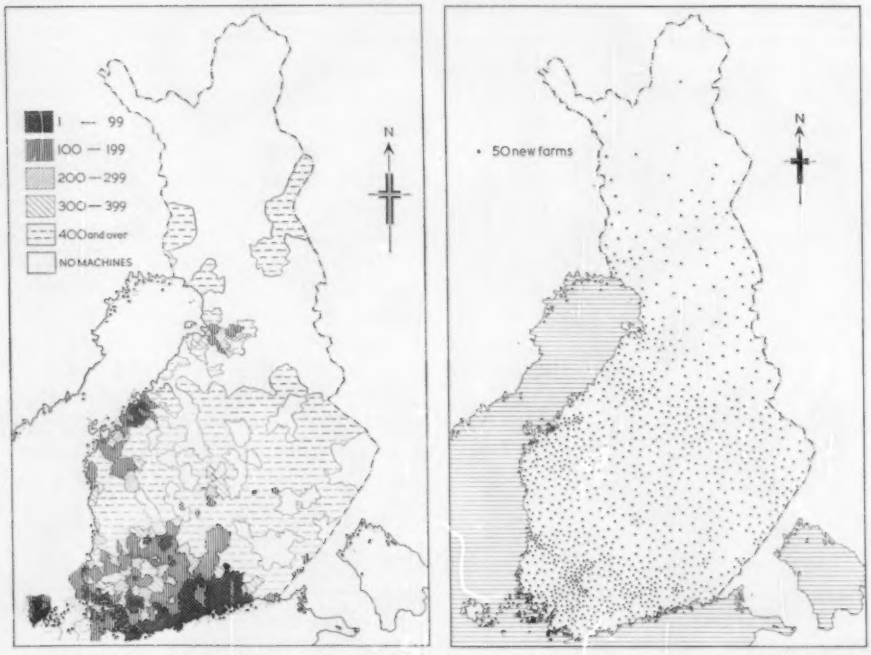


FIG. 5 (left). Relative density of milking machines. The figures express on a parish basis the number of milk cows per machine in 1950. (Source: *The 1950 Census of Agriculture*, IV, Helsinki, 1954).

FIG. 6 (right). Increase in number of farms, 1941–50. (Source: *The 1941 Census of Agriculture*, 38, 3, Helsinki, 1948; *The 1950 Census of Agriculture*, II, Helsinki, 1954.)

The winter management of stock and fodder has called forth another significant change in the Finnish rural scene: the concentration of the farm building complex. This implies not merely the centralization of dispersed storehouses, sheds, and processing buildings, but frequently also their organization into one unitary building. The rationalization of farm buildings has, in fact, shown a tendency to take precedence over other investment. On the new holdings of displaced farmers, the unitary building has been established at the outset and frequently distinguishes them from older farmsteads.

The ultimate consequence of technical improvements is increased yield per unit of labor expended. But the substitution of mechanical power for human effort does not relax Finland from its position of international dependence, because the fuel behind motorization derives from outside sources.

CHANGES IN THE POPULATION PICTURE

Few countries in Europe have witnessed or are witnessing such lively population changes as present-day Finland. These changes have had and are having a direct effect upon agriculture. Finland's population of four millions gives a density of 34 per square mile and 1.5 acres of arable land per head. A fundamental redistribution of a tenth of the country's population took place after a tenth of its land area was ceded to the U.S.S.R. in 1944. The resettle-

ment of the dominant farming element among the displaced people called for 35,000 new farms. These were either acquired through the division of existing holdings or created through the establishment of new holdings in the woodlands. Both methods resulted in an intensification of rural settlement; but neither furthered rationalization of agriculture. The increase in number of rural holdings (to which are added others than those resulting from resettlement) is given in Figure 6. There were several immediate consequences. First, a considerable number of the most commercially successful holdings in the country suffered changes in shape and losses of territory which destroyed the value of much of their capital investment. Too often, the farm with surplus production suffered a fundamental structural disturbance to give life to a subsistence holding. The multiplication of what might be called pigmy farms and the threat of a peasant (albeit peasant-owner) proletariat followed. Secondly, valuable timber in accessible areas had to be sacrificed in favor of small holdings, the crop returns from which could not be expected to approximate to the softwood returns—at least not for a long period. Social necessity, in fact, forced the hand of economic expediency. Yet despite this disruption, by the time of the new census, the resettlement of Finland's displaced farmers was virtually complete and agricultural output (from nine-tenths of the pre-war area) had been restored to a pre-war level. Since the census, of course, it has been lifted well above that level in virtually every respect. By dint of vigorous land reclamation, which has not always been in the national interest, the total cultivated area has also been restored to its former total. Some idea of the distribution of land reclaimed between 1940 and 1950 censuses is given in Figure 7.

The impact of displaced people upon the rural fabric of Finland has tended to obscure a second population change which has been brought to light by the 1951 census. Finland's predominantly rural population has been transformed into a predominantly urban population. Simultaneously, the number of agriculturally employed has fallen in proportion to the number of industrially employed. The watershed has been crossed in the intercensal period. A rural exodus is indicated by the diminishing pool of agricultural labor. The average Finnish farm is owner-operated; but, where there is no regular hired help, there is frequently a seasonal employment of labor. Farm labor has commonly migrated to industry in a country where agricultural wages have not merely lagged behind factory wages, but where inflation has outstripped that of many European countries. Too often in country districts, the crowded hours of summer are complemented by a serious underemployment in winter, so that at least one geographer has asked "Are Finland's rural districts overpopulated?" (H. Smeds, *Publications from the Geographical Institution of Helsinki*, 14, 1951). The mechanization of Finnish farming and the rationalization of farm buildings are inseparable from changing labor conditions. Nevertheless, it is an interesting comment on the present agricultural status that if demand as expressed by population and farm output be set side by side, an 85 per cent self-sufficiency is claimed.

THE WOOD BEYOND THE WORLD

Besides dealing with the processes of change, this essay has been concerned with the bare bones of the classical economists—land, population, capital. It has omitted reference to management.

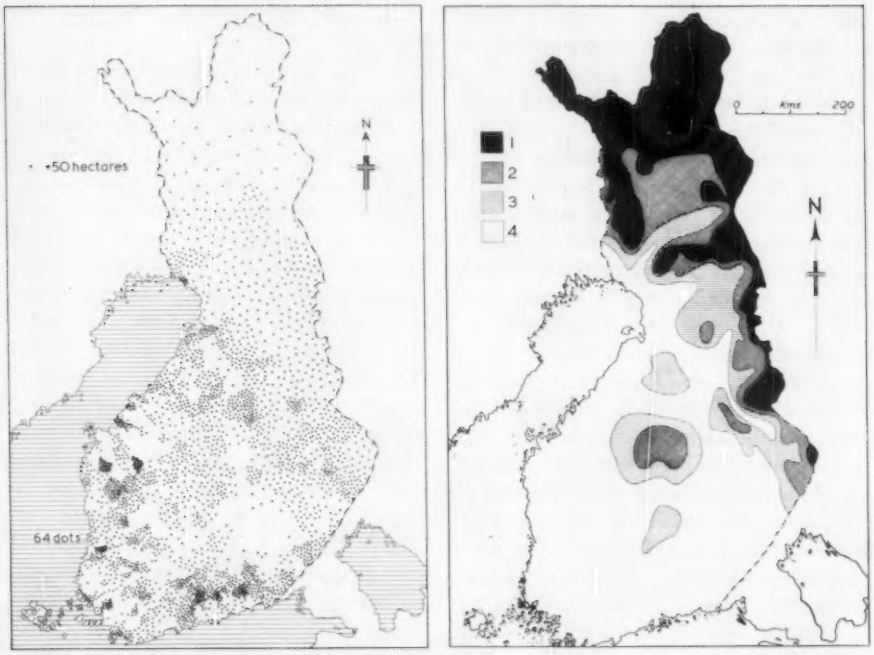


FIG. 7 (left). Reclamation of arable land, 1941–1950. (Source: *The 1941 Census of Agriculture*, 38, 3, Helsinki, 1948; *The 1950 Census of Agriculture*, II, Helsinki, 1954.)

FIG. 8 (right). Forest areas classified as inaccessible in 1952. The shading shows transport costs per cubic meter of pulp wood to coastal factories. 1. Over 2200 Finnish marks, 2. 2000–2200 marks, 3. 1800–2000 marks, 4. Under 1800 marks. (Source: N. A. Osara, *Eräitä valtion metsätalouden ongelmia ja tavoitteitä*, Helsinki, 1953.)

Management at two distinct levels—the national and the individual—is very much the cynosure of those who ponder Finland's rural affairs.

At the individual level, this is largely a matter of education; and, judging from the relative speed of diffusion of biological and technical improvements, agricultural education is in a healthy state. Intensified interest in farming practice, however, is not enough. There has been a serious time lag in the appreciation of forest biology and forest technique among many small private land-owners. Finland's timber resources have never been so thoroughly exploited as today; they have never, in fact, been so satisfactorily maintained. But maintenance is not enough if the rate of timber cutting is to be increased to keep pace with industrial demands. The forest is not only the ultimate capital resource of the country, but also of the greater number of individual farms. Mechanization of the arable land and rationalization of farm buildings (other than on the farms of displaced people) have frequently been paid for by direct sales from the forest. A program of woodland improvement—by draining, selective logging, pruning, thinning, etc., —is urged for every farm. In brief, a balance of attention between forest and cultivated land is sought.

At the national level, a comparable lack of balance prevails. There is widespread appreciation of the changes which are taking place; there has often

been generous capital to meet their needs. But the more rational agriculturalists maintain that an overriding system of priorities should be introduced to the farm picture. The fundamentalists among them put forward what might be called a "back-to-the-land" program and call for investment in the soil (through drainage, boulder clearance, fertilization). They argue that too much capital has, perhaps unavoidably, been invested in buildings and communications in the resettled areas; too much capital has been employed in the piecemeal reclamation from the woodland. Intensification is, perhaps, out of control and should be brought under more formal management.

Foresters, meanwhile, direct attention to a lack of balance at the national level between investment in agriculture and investment in woodlands. A fuller use of the entire forest is urged. While some of Finland's woodlands have been neglected for human reasons, others have never been fully exploited because of transport considerations. On Gylden's map, the areas with the richest timber stands are commonly in the most inaccessible areas. Figure 8, showing the forest areas classified as inaccessible in 1952, provides an interesting complement not only to his map, but also to the maps of farm mechanization and intensification. For 150 years Finland has been constantly reviewing its communicational deficiencies; but it may be fairly said that they have never been projected in such detail as in the map accompanying the Ministry of Transport Proposals of 1952. This is substantially reproduced as Figure 9. It represents a series of compromises—a compromise between the intensification of communications in the metropolitan (and tax-subscribing) southwest and the extension of communications in the "colonial" (and much subsidized) northeast, a compromise between a few, new first-class highways and a network of equally important byways, a compromise between the demands of road transport and rail transport. Finland is still a railway-building and railway-planning country. The rural Finn (to borrow a phrase from William Morris) once lived in a "wood beyond the world." As his woods have been brought into the world, his wealth has been increased—but so have his worries.

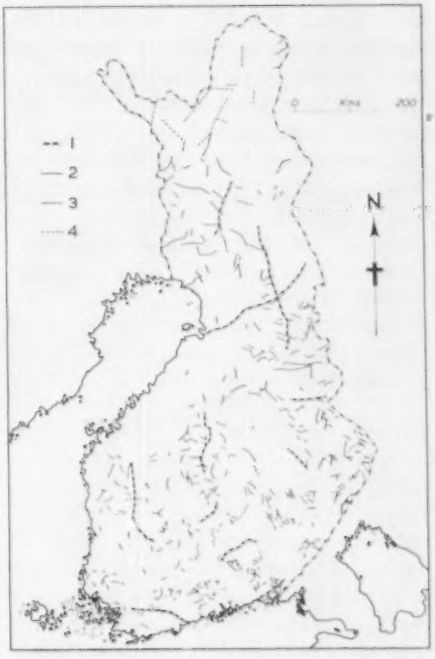


FIG. 9. Plans for new communications in Finland. 1. Proposed railway routes especially for timber transport, 2. Proposed motor roads especially for timber transport, 3. Other proposed railway routes, 4. Other proposed motor routes. (Source: The Development of Land Transportation of Wood, *Silva fennica*, 73, Helsinki, 1952.)

Today, rural Finland finds itself in a unique situation. This is not the first time that territorial losses without have spurred great energies within. After

the "Great Wrath" (*isoviha*) of the eighteenth century, the leaders of Finland turned their attention towards the country's rehabilitation, the rudimentary assessment of its wealth, and the maximization of its domestic resources. After 1808, when the situation was repeated, C. C. Böcker, then secretary of the Finnish Economic Society, was consoled that "during periods of adversity, great forces are released—and the more trying they may seem at the moment, the more beneficial they may well be . . . in their consequences." The Finnish farmer, however, has not previously had to cope with territorial loss and rehabilitation at the same time as he has had to consider Finland's international softwood status, the competition of a vigorous industry and its related attractions of urban residence. He is accustomed to flexing his muscles in the face of adversity. The irony is that, as the difficulties of his physical environment are relaxed, those of his economic environment appear to multiply.

TWENTY-FIVE YEARS' USE OF THE 9-FOOT OHIO RIVER CHANNEL

Thomas F. Barton

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TODAY the Ohio River carries far more inland waterway commerce than any other river in the United States and about twice the paid commerce of the Panama Canal.[1] Yet 25 years ago many people questioned its potentialities and many are still unaware of its present significance. After a stormy debate as to the feasibility and need of providing a minimum 9-foot constant navigation channel in the Ohio, such a project was authorized in 1910 and construction completed in 1929. Now, after using the waterway for 25 years, it seems appropriate briefly to: (1) present the primary arguments for and against the proposal; (2) characterize the growth and nature of water traffic; and (3) discuss plans for future improvement of the channel.

The 9-Foot Channel Proposal

The proposal to canalize the Ohio stimulated a stormy controversy which lasted long after the project was completed and which continues, though somewhat abated, even today.

In retrospect the primary objections that were raised against the original program appear to be these:

First, some thought it was not engineeringly possible to provide a 9-foot channel by means of movable dams or by any other means. Engineers had recommended the use of wing dams and dredging, and both of these were considered failures. There had always been droughts and low-water periods in summer; in all probability there always would be. It was argued that a succession of dams and pools could not maintain a 9-foot channel because of the small amount of rain in late July and August and because of the great loss of water by both evaporation and seepage. It was predicted that ice would handicap winter shipping. Opponents quoted Senator Randolph of Roanoke who sneered "that the Ohio was a stream which was dried up during six months of the year and frozen over during the other six months."[2] The truth is that about 1900 low water and ice jams did prevent the free flow of traffic for about three months in the year. In summary, the opponents contended that the maintenance of a 9-foot channel throughout the year and throughout the 981-mile length of the river was a physical impossibility.

A second primary objection was that even if the channel should become a reality (which was only an assumption for the sake of debate) sufficient traffic would not materialize to make the project economically feasible. A series of arguments were used in an attempt to substantiate this assumption or at least to becloud the issue. The river was too winding and necessitated too long a haul. Water transportation was too slow and could not compete with

[1] *Water Borne Commerce of the United States Calendar Year 1953*, compiled and published by Corps of Engineers, Department of the Army.

[2] John L. Vance: "The Improvement of the Ohio River," *Annals of the Amer. Acad. of Polit. and Soc. Science*, Vol. 31, 1908, p. 141.

rail. The river did not flow in the right direction or connect with the important metropolitan areas. Since the river cannot reach interior points, transshipment by railways and highways would be necessary. Also, opponents scoffed at the idea advanced by the proponents that the river would eventually carry 13 million tons in a year. Opponents inquired, "Had not traffic declined on this river for decades before 1900, and in that year carried only three million tons?"

A third objection was that the program would only benefit industries and cities located on two short sections or stretches of the river. They referred to the 70-mile stretch downstream from Pittsburgh and the section of the river between the mouth of the Kanawha and Cincinnati. It was argued that most of the river would never be used and therefore the program favored only a few cities and industries.

A fourth objection was that tonnage on the Ohio would be restricted primarily to two commodities—coal and stone, sand, and gravel.

Fifth, a balanced downstream and upstream traffic would never develop because most of the commerce would flow downstream with the current.

The sixth primary objection was that the engineers were extravagantly advocating huge locks 110 feet wide by 600 long. Such large locks were not needed and never would be filled.

Seventh, the project would not be economical and offered unfair competition.

Those in favor of the project stressed the following points:

First, by means of wicket movable dams and auxiliary dredging the engineers could provide a 9-foot channel. Six locks and dams already constructed on the Ohio below Pittsburgh had proven successful.[3] In fact, canalization of the entire river was only an extension of a program already in operation.

Second, the proponents maintained that river traffic both as to annual tonnage and ton-miles would materially increase. They believed that in a short time the river would be carrying more than the 13 million tons a year which would make the project economically feasible.

Proponents based their belief in part on the Report of the Board of Engineers for Rivers and Harbors dated October 18, 1907. The following selected paragraphs from that document characterize the faith of those who favored canalization:[4]

[3] House of Representatives, 60th Congress, 1st Session, Document No. 492, Washington, D. C., 1908, p. 10.

[4] *Ibid.*, p. 115. (The first and second paragraphs quoted here are separated in the original text by a paragraph omitted here.)

"The Board, however, is of the opinion that conditions are exceptionally favorable for the future development of commerce on the Ohio River. The river now maintains a traffic of over 9,000,000 tons in competition with railways. This commerce appears to be slowly increasing and its growth appears principally in other products than coal.

. . . . .

"The Board believes that a large commerce is reasonably prospective if these commercial centers are connected by a waterway which will permit the certainty of transportation which is found on existing railroads and that this certainty will be attained by the works proposed in the report.

"The General Government has expended large sums in improving the various tributaries of the Ohio. The utility of these improvements is dependent on the navigability of the main stream. The proposed improvement of the Ohio River will create a vast system of water communication penetrating one of the most populous and prosperous sections of the United States. Even in its unimproved condition the river has a marked effect on the rail freight rates, the cheap rates quoted in the report as prevailing between New Orleans and Louisville, Cincinnati, and Pittsburgh being directly traceable to its influence. Its effect on rail rates will be greatly increased if the proposed improvements are carried out.

"For these reasons the Board is of the opinion that the improvement of the Ohio River by locks and movable dams so as to secure a depth of 9 feet as recommended in the report of the special board is worthy of being undertaken by the United States."

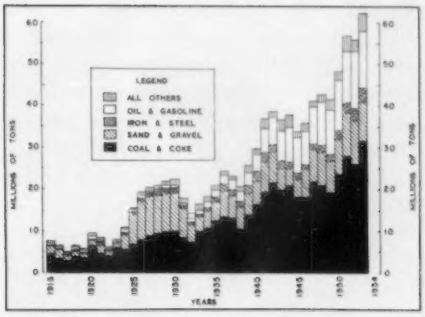


FIG. 1. Changing tonnage pattern, Ohio River (adapted from graph by Corps of Engineers, U. S. Army).

A 9-FOOT CHANNEL BECOMES A REALITY

Now after 25 years, what are the results?

In 1929, after 19 years from the date of its authorization, a 9-foot channel became a reality. Many had ceased to question the physical construction of such a project. They had watched the successive completion of the dams and locks downstream from Pittsburgh open up new and longer sections of the Ohio to 9-foot slack water season navigation. Some people still believed that the project would break down during the first severe drought.

The unprecedented drought of 1929–1931 was the acid test. A 9-foot channel was maintained throughout the summer of 1930. Despite the lack of precipitation, all pools behind the 50 dams were kept at full pool stage. This demonstration proved that in the future navigation could be carried the full length of the river without being handicapped by low water.

[5] Moreover, since 1938, statistics do not include "ferry traffic" which at one time was included in the total annual tonnage. Personal letter from Paul B. Mason, Chief, Technical Liaison Branch, Ohio River Division, Corps of Engineers, U. S. Army, April 12, 1954.

ANNUAL TONNAGE

The column graph, Figure 1, clearly indicates the rapid growth of freight tonnage between 1930 and 1953 or for the first 24 years' use of the 9-foot channel. In 1915 the tonnage was only 7.3 million; however, as a 9-foot channel was developed for longer and longer sections of the river, tonnage increased. In 1928, the last year before the project was completed, the tonnage amounted to nearly 21 million; and by 1953, the last year for which statistics are available, it had increased to over 62 million.[5]

The annual tonnage in the 24-year period (1930–1953) fluctuated but over the years its trend has been consistently upward. The major decline occurred during 1931–1935, which coincides with the Depression Years.

ANNUAL TON MILES

The column graph, Figure 2, shows a comparison by years of the ton miles

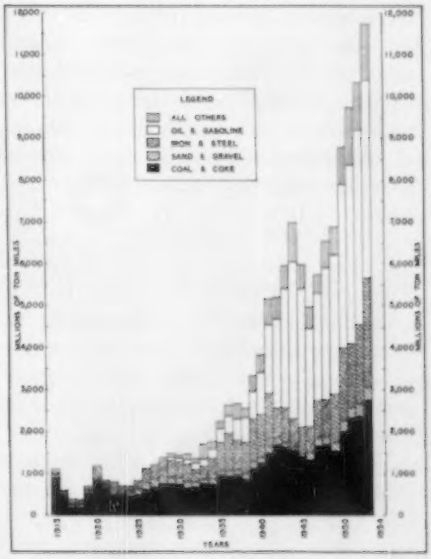


FIG. 2. Comparison of Ohio River ton miles by years since 1915 (adapted from graph by Corps of Engineers, U. S. Army).

and the principal commodities carried. The growth of ton miles has been greater than that of annual tonnage. In 1928 ton miles were only 1.3 billion whereas by 1953 the ton miles had increased to 11.7 billion. This 25-year increase amounts to over 800 per cent.

Along with this enormous increase in ton miles, the use of the entire river from Pittsburgh to Cairo increased rapidly. A critic who hastily evaluated the 9-foot channel project on the basis of freight carried during 1930 wrote:

> "By way of summary of traffic it may be noted that of the 22,337,000 tons of freight transported on the river during the year, about half is confined to the first 16 miles of the river, which is in the city of Pittsburgh and its immediate adjoining suburbs; that about 675 miles of the total 981 miles of improved river carried an average of only about 750,000 tons during the year 1930. . . . It is clear that approximately two-thirds of the river is little used."[6]

In contrast with the statement that "about 675 miles of the total 981 miles of improved river carried an average of only about 750,000 tons during the year 1930," by 1953 no portion of the river carried less than 8.8 million tons—an increase of more than 1000 per cent in 23 years. Moreover, whereas prior to canalization the lower part of the Ohio carried little commerce, no portion of the river below Cincinnati carried less than 10 million tons in 1953.

Commodities Carried

Tables released by the Corps of Engineers, United States Army for 1953 give statistics for the following groups of commodities: coal and coke; stone, sand, and gravel; iron and steel; oil and gasoline; sulphur, chemicals, and all others.

Tonnage statistics for 1953 indicate that coal and coke rank first in amount followed by oil and gasoline; stone, sand, and gravel and iron and steel. However, ton-mile statistics show oil and gasoline in first place, followed by coal and coke; iron and steel; and chemicals. Although large quantities of stone, sand, and gravel are hauled, they are hauled relatively short distances and seldom the complete length of the river, whereas iron and steel, oil and gasoline, and sulphur and chemicals may enter the river at Cairo and move to Pittsburgh.

Direction of Traffic Flow[7]

The original structures providing a 9-foot channel were designed and built primarily to facilitate down-bound movements of coal and iron and steel. Prior to 1940, most of the commerce on the Ohio had moved in this direction.

Since 1940 the down-bound and up-bound traffic has become nearly equalized. For example, in 1942 up-bound tonnage originating on the Ohio amounted to 4.7 million tons and the down-bound traffic was 8 million, or nearly twice as large. However, by 1952, up-bound tonnage originating on the Ohio totaled 10.5 million and the down-bound, 11.9 million.

During the last ten years (1943–1953), up-bound through traffic has been at least three to four times greater than the down-bound through traffic. In 1953, through up-bound traffic amounted to 3.2 million tons whereas through down-bound tonnage was only 1.1 million.

Size of Locks

Against some opposition, the engineers recommended and constructed at each movable dam primary locks 110 x 600 feet. A few auxiliary locks 56 x 360 feet are found at some of the non-movable dams.[8]

[6] J. E. Switzer: "The Completed Ohio River Project," *Proceedings of the Indiana Academy of Science*, Vol. 41, 1932, pp. 16 and 17.

[7] Data furnished by Corps of Engineers, U. S. Army.

[8] Only one auxiliary lock is associated with a movable dam, namely, at Dam No. 41, Louisville, Kentucky.

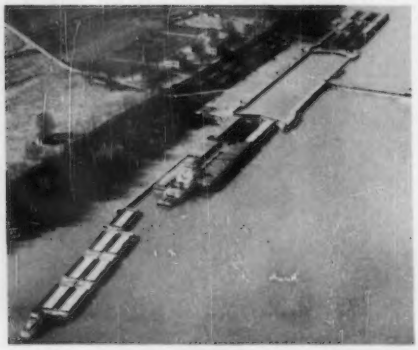
FIG. 3. Motor vessel "Aetna-Louisville," up-bound on March 24, 1955, at Louisville with eight barges carrying 30,599 tons of petroleum products. (Courtesy of Corps of Engineers, U. S. Army.)

The small size of the locks is one of the greatest handicaps to river traffic today. Although a 600-foot lock was considered by some exorbitantly long in 1910, they are now too short and form bottlenecks to the smooth flow of traffic. Many of the modern tows measure over 1000 feet in length (Fig. 3). Tows of this length must be broken into two or three or even more sections in order to fit the lock chamber.

The breaking of the tow and double locking is a laborious, slow process costly both in time and money (Figs. 4 and 5). Moreover, for a tow moving the length of the river it must be repeated at each of the 46 locks during low water stage. In addition, time is lost by other tows which must wait their turn while the double locking is in process. It takes about 90 minutes on the average for a long tow to double lock at a dam. As the number of large tows and the volume of traffic mounts each year the time lost in double locking and waiting for a turn to lock becomes increasingly serious. Even the long, speedy, one-barge wide tows must be broken and the two sections placed in the lock side by side in order to negotiate a single lockage.

IN RETROSPECT

In retrospect the development of navigation since 1929 has eloquently answered six primary objections raised against providing a 9-foot channel. The 9-foot channel has been a physical reality for 25 years. Tonnage increased from less than 5 million tons in 1917 to over 62 million tons in 1953. Traffic is well distributed throughout the river with no section carrying less than 8.8 million and with more than 800 miles



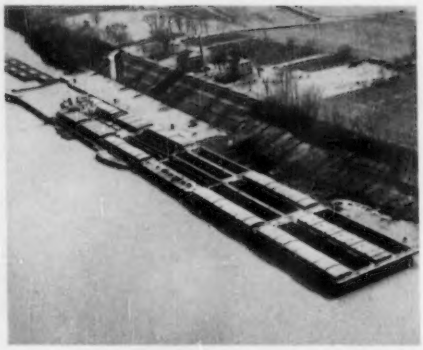


FIG. 4 (left). The first section of 12 barges in the tow of motor vessel "Pennsylvania" have passed through the lock and are moored along the upper guide wall. The upper lock gates are being closed to prepare the lock for the second section. The motor vessel "Margaret Dawson" with seven empty sand barges is waiting at the end of the lower guide wall. (Courtesy of Corps of Engineers, U. S. Army.)

FIG. 5 (right). The two sections of the tow shown in Figure 4 have been coupled into one unit. The head of the tow has passed the end of the upper guide wall. As the motor vessel "Pennsylvania" is still in the lock chamber, the tow will move straight ahead for some distance before moving out into the river channel. The tow of the motor vessel "Margaret Dawson" will go through as soon as the locked chamber can be prepared. (Courtesy of Corps of Engineers, U. S. Army.)

carrying over 10 million tons. The entire 981-mile channel is being used. In ton miles, iron and steel, oil and gasoline, and even chemicals outrank stone, sand, and gravel by three to 20 times. Through up-bound traffic in recent years has been about four times as great as through down-bound tonnage. The 600-foot long locks did not prove to be too long but rather too short. The Report of the Board of Engineers for Rivers and Harbors dated October 18, 1907, was not too optimistic but rather ultra-conservative.

INDUSTRIAL LOCATION

The assurance of a 9-foot channel throughout the year has encouraged the location of industry in the valley. After the first experimental dams to provide a 9-foot channel below Pittsburgh were approved and before they could be constructed, industry began buying riparian factory sites. By 1907, even before canalization of the entire river was approved, practically all industrial sites on the Ohio for a distance of 30 miles below Pittsburgh had been purchased.[9] Since then, industry has continued to buy and develop industrial sites up and down this river and some of its navigable tributaries, particularly the Monongahela, Allegheny, and Kanawha.

Industrial location along the river following the economic stalemate of the 1930's has been especially rapid. It is estimated that more than 2500 factories have been located in the basin since the end of Second World War.[10] In a lecture in Toledo, Major General Sturgis, Jr., reported that during the second quarter of 1953 alone 75 sites for plants, each costing more than a million dollars, were located in the Ohio valley, along with hundreds of others costing less.[11]

Recent industrial expansion is exemplified by the atomic and chemical industries. Within a 250-mile radius

[9] House Document No. 492, *op. cit.*, p. 21.

[10] Major General S. D. Sturgis, Jr.: "Ohio's Two Seaways," Mimeographed address given in Toledo, Ohio, March 27, 1954.

[11] *Ibid.*

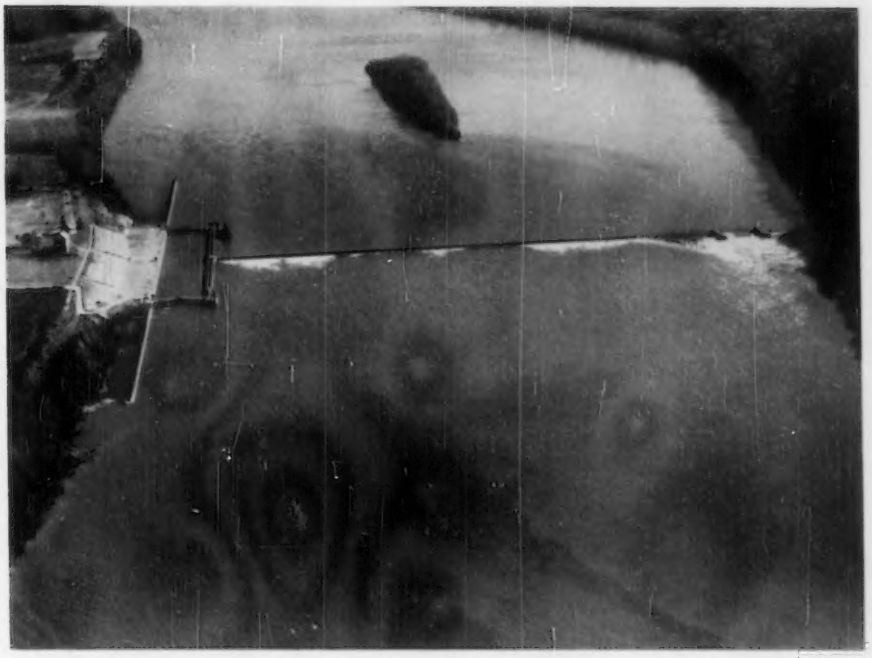


FIG. 6. Looking upstream at Lock and Dam No. 44 on the Ohio River. (Courtesy of Corps of Engineers, U. S. Army.)

of Cincinnati alone is almost 70 per cent of the Atomic Energy Commission's planned development east of the Mississippi River. Government-owned atomic plants will represent an investment of over four billion dollars.[12]

Also, the Ohio watershed is well known for its rapidly expanding chemical industry with its larger centers in the upper Ohio and its tributaries and in the Kanawha valley and with smaller areas at Cincinnati and Louisville. Several other recently developed and expanding centers have started, such as Calvert City.

While additional investigations need to be made and published as to why the new factories have located in the valley, a detailed investigation has been made of the chemical industry along the midwestern river and intracoastal canal routes.[13] This study substantiates the vital role that barge transportation has made in encouraging factory location here. Undoubtedly, some of the factories located in the valley have no relation to the availability of water transportation. However, as the years go by and larger dams are constructed and bigger pools of water created, fewer industries can escape being influenced directly or indirectly by navigation improvements. These big pools of water will not only improve water transportation facilities but the water can be used in other ways.

In summary, some of the important factors influencing the rapid location of

[12] Thomas Frank Barton: "Atomic Energy and the Ohio River," *Proceedings of the Indiana Academy of Science*, Vol. 64, 1954.

[13] J. Edwin Becht: "The Chemical Industry and the Midwestern River and Intra-Coastal Canal Routes," *Waterway*, October, 1955, p. 15.

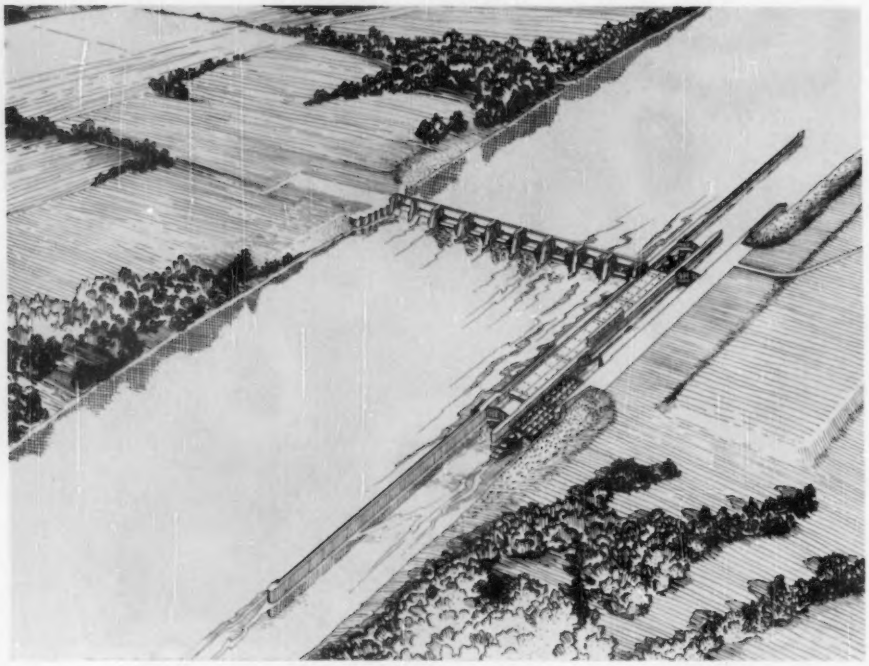


FIG. 7. U. S. Army Corps of Engineers sketch of artist's conception of the Greenup dam and lock when completed.

industry in the valley are: (1) an abundance of coal, petroleum, and other minerals and materials moved by efficient barge transportation; (2) an abundant water supply from the second largest river in the United States, and (3) the possibility of using the river for ultimate waste disposal.

THE NEXT TWENTY-FIVE YEARS

If the annual tonnage on the Ohio can increase from 3 million tons in 1900 to over 62 million tons in 1953, what should one estimate the amount of traffic to be in the next 25 years? It is estimated that over 18 million tons of coal will be required annually to run the three gaseous diffusion plants at Oak Ridge, Paducah, and Portsmouth at full capacity for a year and most of this is expected to move by barge. To understand what this potential increase in barge transportation will mean in stimulating business in and along the river we should recall that the greatest coal tonnage hauled on the Ohio in any one year was a little over 31.7 million tons; that was in 1953.

The soaring traffic load has placed an enormous strain on the structures providing the 9-foot channel. When constructed, it was thought that they might be called on to provide facilities for 13 or 15 million tons of traffic a year. Most of the dams have been in constant and heavy use for 30 to 50 years.

Today we are faced with a new proposal, Should we again modernize navigation facilities on this river? Briefly, the plan is to replace completely 41 of the old and inadequate locks and dams

of the existing system of 46 structures (Fig. 6) with 16 higher lift dams and larger modern locks, and to modernize and enlarge the remaining five existing locks and dams. For example, the Greenup dam will eliminate the need for the present movable dams and locks numbered 27, 28, 29, and 30 and will create a pool 12 feet deep and 68 miles long (Fig. 7). The replacement and modernization programs will require about 20 years to complete and will result in reducing the total number of dams from the existing 46 to 21. The Corps of Engineers recommended that the first three dams in this program should be the Greenup near the Ashland-Huntington area, the New Cumberland below Pittsburgh, and the Markland below Cincinnati. All three of these projects have been authorized and the New Cumberland and Greenup are now under construction.

The new permanent dams are to be modern navigational structures with the main lock measuring 110 feet by 1200 feet. This would provide twice the capacity of most of the locks. Smaller auxiliary locks will be 110 feet by 600 feet.

These permanent dams will provide much longer pools with deeper water. Local barges in some of the pools may draw 12 feet of water. The larger pools with fewer locks will greatly reduce the time now spent in locking, and water levels in the bigger and deeper pools also will fluctuate less frequently. With their greater stability and higher levels, they will benefit terminal operations, carriers, and shippers alike. Furthermore, they will make domestic and industrial water supply withdrawals easier and more dependable.

SUMMARY

The Ohio River's role in water transportation is unique. The success of this artery of commerce should not be used to justify river transportation in all parts of the United States. If the second program of improvement is adopted and completed during this century, there may be a continued substantial growth of traffic on the Ohio. Moreover, the needs and demands for water are increasing. Only the Mississippi River in the United States carries a greater volume of water than the Ohio and it lacks the potential reservoirs found in the Ohio Valley. Consequently, the Ohio provides the greatest potential river water supply in our country. Therefore, during the years ahead, it seems reasonable to believe that the multiple use of this river's water will receive increased attention.

EXAMPLES OF CHANGING PEASANT AGRICULTURE IN CROATIA, YUGOSLAVIA*

W. B. Johnston and I. Crkvenčić

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DURING the last hundred years new patterns have evolved in the character of rural life and rural economy in Yugoslavia. Undoubtedly the processes and results of change have been modified by two World Wars, economic depressions, and the implementation of different political and economic doctrines. Nevertheless, a fundamental influence has persisted throughout the period. It is the penetration of new and powerful commercial incentives and the decay of traditional subsistence economy.

Despite the general development and intensification of agriculture within the Republic of Croatia, comparative statistical data for 1900–1914 and 1953 show a decline in cultivated area that is most marked in the case of arable land[1] (Fig. 2). This downward trend, which began even earlier than 1900, is not uniform over all of Croatia or characteristic of all areas. A basic distinction exists between the Karst region of the southwest, and the hills and plains of the Danubian Basin in the northeast (Fig. 1). The former is a region of agricultural recession; the latter a region of agricultural advance. This dual regional division is fundamental to an understanding of the changing character of peasant agriculture in Croatia. The overall decline in cultivated area is a result of widespread abandonment of land in the southwest, in excess of the areal extension of agriculture in the northeast.

An important key to the divergent agricultural trends lies in the physical nature of the two regions. The mountainous southwest is part of the famed Karst of Yugoslavia. It is composed mainly of Mesozoic limestone and dolomite, neither of which provides fertile soils to favor the improvement of agriculture. Further, the modified Mediterranean climate is frequently characterized by insufficient rainfall during the growing season, especially along the coast.

During the twentieth century the

*This article is an elaboration of papers read by I. Crkvenčić at the Geographical Society of Croatia, May, 1953, and by W. B. Johnston at the New Zealand Geographical Society Conference, August, 1955.

[1] Throughout this article the following definitions apply: *Arable land:* land in grain crops, vegetables, orchards, vineyards, clover, and lucerne. *Meadow:* land in grass cut regularly for hay, with few trees; grazing is secondary. *Cultivated land:* arable land and meadow combined. *Pasture:* land in grass used primarily for grazing and commonly dotted with trees; hay may also be cut from pastures. *Forest:* land devoted primarily to trees or woodland, though the grass underneath may occasionally be grazed. *Unproductive land:* unused land.

All statistics are based on official sources; in particular they are based on detailed cadastral maps and accompanying reports which provide unequalled records of conditions almost a hundred years ago.

coastal towns and villages have provided new opportunities for earning money in tourism, industry, and trade. The increased food demands of the urban populations have been partially met by the intensification of agriculture around the towns, but, beyond these fringes, the cultivated area has decreased and the population of rural villages declined in the face of more regular and profitable sources of employment.

In contrast the northeastern region is lower in elevation and less mountainous. The hill country is composed of soft Tertiary rocks with protruding summits of older and harder material such as limestones, granites, and schists while the eastern alluvial plains contain extensive areas of marshland as well as drained, level surfaces which are frequently covered with fertile loess deposits. Compared with the Karst, the more favorable surface configuration and the deeper and richer soils combine with continental climatic features to provide a profitable basis for the extension of agriculture. In addition, the increase in cultivated land was particularly associated with the decline of feudalism and an increase in population, the break-up of the *zadruga* (collective households), and the rise of individual peasant households in the late nineteenth century.

Somewhat similar social and economic changes occurred in the Karst region yet there was no enlargement of the cultivated area. Here the new social responsibilities and economic opportunities tended to make the tilling of land an unprofitable means of employment. Industry, tourism, and transport gave better returns and often it was cheaper, as is true in certain cases today, to buy food from other areas than to produce it locally. The peasant of the Karst, long engaged in a difficult

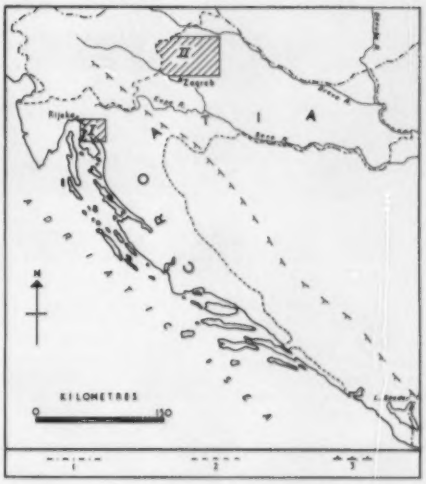

FIG. 1. Location map: 1, Boundary of Yugoslavia; 2, Boundary of Croatia; 3, Inner margin of Karst; I, Northwest Hrvatsko Primorje; II, Hrvatsko Zagorje.

agricultural life, readily appreciated new sources of supplementary income and turned his back on sub-marginal land. In addition the area is generally one of older colonization and of greater population density in relation to productive land. There did not exist—as was the case in the Danubian Basin—good land, well situated, which could be brought into cultivation.[2]

This study is an attempt to indicate some of the distinctive agricultural changes that have occurred in the two regions. Within the broad regional setting of both the Karst and the Danubian Basin, a specific village and its land are analyzed in detail to illustrate the character and direction of changes especially within the last hundred years (Fig. 1).

[2] Between 1890 and 1910 a large number of people left Hrvatsko Primorje. On the average, each year during this period, for every 1000 people in Sušak 5.5 left the district. The figure was substantially higher for Crkvenica (22.7) and Senj (17.1). See *Statistički Atlas Kraljevina Hrvatske i Slavonije 1875–1915*, Zagreb, 1915, Table 25.

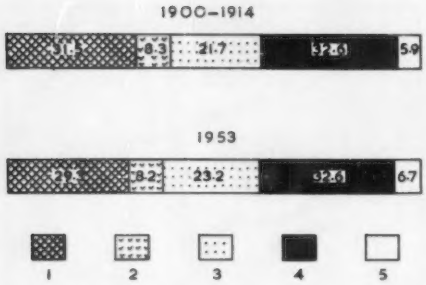

FIG. 2. Percentage land use in Croatia in 1900–1914 and 1953. (The period 1900–1914 is used because the revision of cadastral maps on which the statistics are based was spread over these years): 1. Arable land; 2. Meadow; 3. Pasture; 4. Forest; 5. Unproductive land.

NORTHWEST HRVATSKO PRIMORJE[3]: REGIONAL SETTING

Until the beginning of the eighteenth century the mountainous district which separates the Danubian Basin from Hrvatsko Primorje formed isolated country. It was largely a forested region, and the few inhabitants were largely occupied with the cultivation of small strips of wheat and barley and the grazing of sheep and goats. In addition, they often turned to the production of timber for export to Venice or for sale to the iron smelters of feudal Čabar.[4] The problems of development were increased by frequent Turkish invasions and most of the inhabitants fled before the conquests of these invaders in the sixteenth and seventeenth centuries.[5] The physical isolation of Hrvatsko Primorje was also accentuated by the state of political instability and economic weakness within the Danubian Basin where constant struggles with the Turks were taking place. Therefore, there was neither great interest in trade nor in fostering ties with the coastal areas where life was developing under a system of feudal agrarian organization.[6]

Hrvatsko Primorje falls into two parts. The southeastern section consists of a barren and precipitous coast backed by mountains which rise over 1500 metres in elevation. This inhospitable area is sparsely populated. In contrast the northwestern section contains important agricultural areas and supports a relatively dense population. Within the latter section the walled town was the feudal economic center. Beyond the walls lay the arable fields, giving way further afield to pasture and forest. All land was owned by the feudal aristocracy, but the cultivation of land was essentially the responsibility of the peasants who were obliged to fulfill various payments in money, kind, and service to the feudal lords.[7] Under this agricultural system each peasant household tended to produce all its domestic requirements.

The fall and execution of the feudal lords of Hrvatsko Primorje in 1671

[3] Hrvatsko Primorje is the regional name for that part of the Croatian coast between Rijeka in the northwest and Lukovo in the southeast (Fig. 3).

[4] See E. Laszowsky: *Gorski Kotar i Vinodol*, Zagreb, 1923, pp. 1–6.

[5] Much of the area discussed here lay on the northern margins or within the special marchland of the "Military Frontier" which was organized in 1578 by the Austrians as a southern frontier against the Turks. Despite Croatian opposition and the decay of Turkish power the western sector was not finally abolished until 1881. See *The Cambridge Modern History Atlas*, Cambridge, 1912, Map III.

[6] An old road from Rijeka to Zagreb crossed the Karst and was an important trade route between the coast (salt and colonial goods) and the northeast (animals and grain). The ports of Hrvatsko Primorje, especially Rijeka, Bakar, and Novi were of considerable importance and served as links between the Danubian Basin and Venice. With the Turkish conquests of the sixteenth century the road ceased to be important and the trade was diverted through Slovenia. See R. Bićanić: "Važnost Rijeka u Ekonomskom Životu Hrvatske," in *Rijeka, Zbornik*, Zagreb, 1953, pp. 153–188.

[7] Sixteenth century documents show that the peasant of that time was under the following obligations: *bir* (taxes in money); *sul* (share of animal produce); *potoku* (share of wine); and *ognjišćinu* (monetary tax on fireplace). In addition he worked a definite number of days for his master. See E. Laszowsky: *Urbar Vinodolskih Imanja Knezova Zrinskih*, Zagreb, 1915.

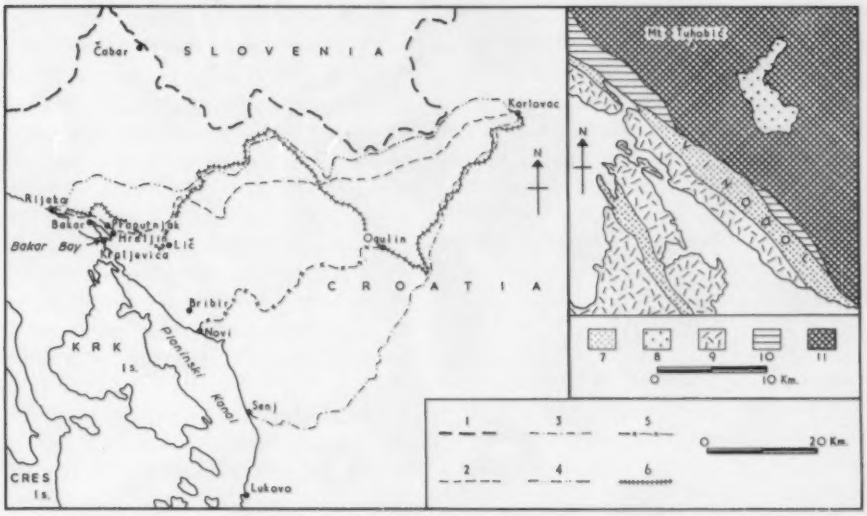

FIG. 3. Northwest Croatia: 1. Boundary between Croatia and Slovenia; 2. Karolina road (1726); 3. Josefina road (1779); 4. Louisiana road (1809); 5. Rudolf's road (1878); 6. Zagreb-Rijeka railway (1873).

Northwest Hrvatsko Primorje: 7. Depression floored with Flysch and recent deposits, densely settled and intensively cultivated; 8. Polje with cultivations and settlement; 9. Low Karst largely composed of Mesozoic limestones, partly wooded and with mainly coastal settlement; 10. Dolomite terrace with cultivations and dense settlement in the northwest section, and rough pasture and no permanent settlement in the southeast section; 11. High Karst largely composed of Mesozoic limestones, extensively wooded (brushwood) and with no permanent settlement.

heralded an era of great change. Their land was confiscated and became state property. Later it was sold to other feudal lords and by agreement in 1757 the peasants formally gained greater freedom in the management of their family economy.[8] About the same time the improved road network gave rise to new centers of population and concentrated existing settlements. Another important factor was the general state of security in the country after the treaty of 1699 by which the Turks were finally eliminated from all of Croatia. The expansion of settlement that followed was reflected in the removal of town walls and the extension of built-up areas. To compensate for the loss of agricultural land to new buildings and to meet the food demands of increasing population, the forest remnants which separated the town fields were cleared and the land brought into cultivation.

The construction of new roads added important links between the Danubian Basin and the Adriatic coast (Fig. 3). Some of the increased grain production of the basin now found an outlet westwards via the rivers Danube, Sava, and Kupa to the town of Karlovac whence ran the new Karolina road (1726) to Bakar and Rijeka, and also the Josefina road (1779) to Senj. In 1878 Rudolf's road across the Kapela mountains was completed from Ogulin to Novi to facilitate the large trade in timber exports. The construction of these and other roads concentrated trade in the larger seaports such as Senj and, particularly, Rijeka, to which Zagreb gained rail connection in 1873. Thereafter, the

[8] See Laszowsky: *op. cit.*, p. 198. Full ownership of land by the peasants was not achieved until 1848.

smaller ports were forced to depend on their immediate hinterlands and, with the advent of vessels of greater draft, even local trade was further restricted until now the coastal passenger steamers provide the chief maritime link and tourists the principal source of income. Somewhat exceptional were Bakar and Kraljevica where small shipyards were established.[9]

Shipbuilding and tourism replaced trade and commerce in the ports. Only one, Rijeka, has grown into a major port, through the construction of rail links to tap an extensive inland hinterland and through the expansion of an artificial harbor.[10] The new profit-making avenues unsettled the peasant economy and after a short period of economic prosperity the decline began. The agricultural settlements both inland and near the coast decreased in number and importance as their inhabitants sought jobs in shipyards and abroad. In the coastal settlements, however, the loss of trade was largely balanced by the growth of tourism towards the end of the nineteenth century.

Population figures reflect this change. Between 1880 and 1910 an increase in population was common in the coastal settlements while the main agricultural districts sustained decreases. After 1910 nearly all areas of northwest Hrvatsko Primorje showed decreasing populations and this trend is still apparent.[11]

[9] Shipbuilding developed rapidly at the beginning of the eighteenth century and was based on the proximity of extensive forests on the Karst, sheltered places along the shore, centuries of sea tradition amongst the coastal people, and abundance of cheap labor. Between 1833 and 1860 some 530 vessels totaling 184,976 tons were built in the shipyards of Rijeka, Bakar, and Kraljevica. See R. Bićanić: *Doba Manufakture u Hrvatskoj i Slavoniji, 1750–1860* Zagreb, 1951.

[10] Rijeka was created as an Adriatic and Mediterranean outlet for Hungarian trade as was Trieste for Austrian trade. See A. E. Moodie: *The Italo-Yugoslav Boundary*, London, 1945, pp. 105–135.

PRAPUTNJAK: PEASANTRY TO PROLETARIAT

The location of villages within the Karst and the arrangement of their cultivated lands are largely dependent on the availability of water and the character of the rocks. The areas of dolomite are especially favored because the rock retains moisture and weathers more readily into a useful soil. Many of the villages outside of the polje are therefore located along the zones of dolomite, and Praputnjak is a good example.

The village land of Praputnjak extends inland from the sea in a narrow belt about one kilometre in width and eight kilometres in depth. It crosses a series of Mesozoic rocks which lie parallel to the coast and increase in age and elevation inland from Bakar Bay. Around the bay, steep limestone cliffs rise abruptly to 200 metres above sea level. Less than a kilometre inland lies a narrow strip of dolomite along which runs the Karolina road and the street village of Praputnjak. The dolomite zone, only a few hundred metres wide, has a sharp southwest-facing slope into a major sinkhole—known locally as Dolac—which is situated at the contact of limestone and dolomite. Further inland the land rises to an eroded surface of pure limestone about 400 metres in elevation. This in turn gradually merges into an area of limestone and dolomite at an average elevation of 700 metres until the inland limit of the village land is marked by Mt. Tuhobić at a height of 1106 metres.

Despite the marked karstic features and the paucity of surface water, the inner zone of limestone and dolomite is agriculturally important (Fig. 4). Because of the higher elevation it

[11] Rijeka is the most important exception. Its population increased from 5132 in 1776 to 75,112 in 1953.

receives heavy rainfall, while the weathered dolomitic soil, concentrated in sinkholes, supports the most important meadows of the village. Pasture occupies the more barren limestone slopes towards the coast while the higher inland area is still forested. The coastal dolomite and the Dolac slopes form the main arable area whereas the steep cliffs around the bay have been elaborately terraced for vineyards to capitalize on the excellent aspect. This arrangement of land use is important in the structure of the peasant economy. From the coastal zone come local food crops, and wine for sale or for bartering for potatoes with other villages. The inland pastures and meadows are all important for grazing livestock which are kept primarily for domestic purposes.

Formerly the economy was dominated by grazing and the extensive areas of pasture and meadow on the planina supplied feed and fodder.[12] Sheep and goats were most numerous and some households owned as many as a hundred sheep. Arable crops from the coastal zone included barley and wheat but, areally and economically, vineyards were of prime importance. In the second half of the eighteenth century the greater freedom given the peasants in the organization of their economy allowed an expansion of those crops which were of greatest value to the people themselves. It was the vine which benefited most since wine commanded a wide and ready market. Thus, by 1862, the cadastral maps showed vineyards as the principal element in the arable landscape (Fig. 5).

The original settlement consisted of scattered and poorly constructed buildings of wood or stone on the slopes of

[12] This section is partly based on T. Franić: *Hrvatsko Primorje I, Meja i Praputnjak*, Beograd, 1937.

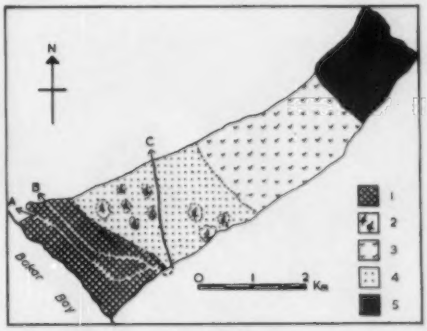

FIG. 4. Generalized land use of Praputnjak village lands: 1. Arable land; 2. Vineyards in solution hollows; 3. Meadow; 4. Pasture (with vineyards in solution hollows); 5. Forest; A. Road to Bakar; B. Karolina road to Rijeka; C. Road to interior.

Dolac. The construction of the Karolina road (1726), which was routed higher up the slope, soon furnished an attractive site and impetus was given towards the concentration of the village along the new routeway. The change was gradual and was not complete until the beginning of the twentieth century. The movement to the new site depended on tanks for holding the household water supply. The money for their construction was acquired, at first, by local wage-earning and, later, in the second half of the nineteenth century, by remittances from family members who had emigrated overseas, principally to the United States.

The new road encouraged economic change especially after 1778 when Bakar became a free port and thereby increased its trade.[13] The villagers were in demand as carriers while the continued development of shipyards at Kraljevica and Bakar provided employment for a large number of inhabitants. In 1809 another road—the Louisiana road—was opened to connect Bakar and the interior, and this brought

[13] See R. Strohal: *Uz Lujzinsku Cestu*, Zagreb, 1935.

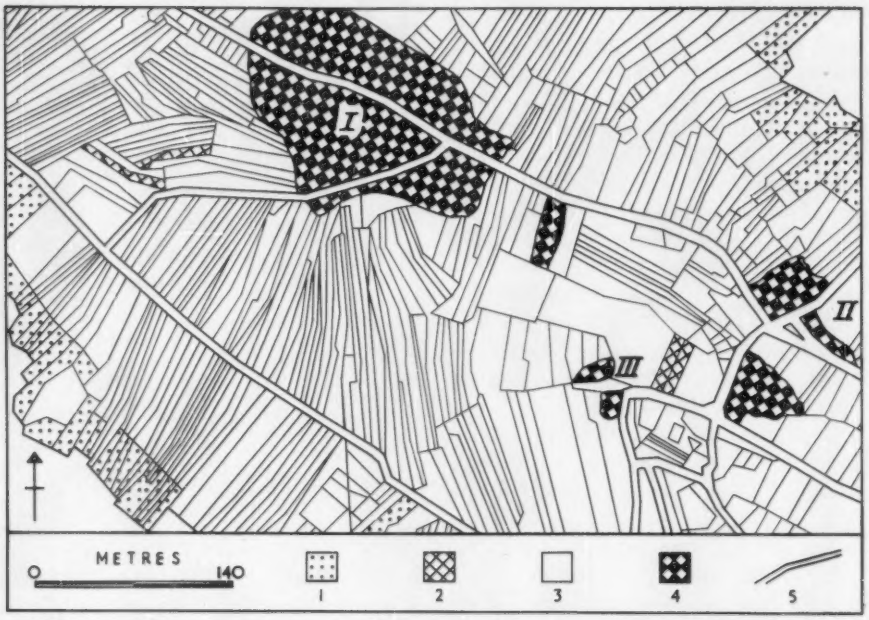

FIG. 5. Detailed land use around Praputnjak village in 1862 showing the pattern of strips: 1. Pasture with some woodland; 2. Arable land excluding vineyards; 3. Arable land including vineyards; 4. Settlement; 5. Roads; I. Praputnjak settlement; II. Meja settlement; III. Dolac settlement.

a further increase in trade and a greater demand for village labor.

The impact of these varied factors led to the abandonment of zadruga, the division of large estates, and the desertion of agriculture in favor of other sources of livelihood. Indeed, little impetus was needed to bring about a decline in the importance of agriculture, because the marginal economic character of the area had never provided a large return or a ready reward as compensation for the physical difficulties that had to be overcome. This transformation began earlier than in northeast Croatia where similar developments had to await the peasants' emancipation from feudal conditions in 1848.

During these prosperous years the village of Praputnjak extended its ribbon form eastwards along the Karolina road to the junction with the Louisiana road where a new part of the village arose. This was Meja ("fence") situated at the boundary between the districts of Hreljin and Bakar. Several inns, a toll-house, and quarters for travelers and carriers formed the nucleus of the new settlement which soon grew in size to link Praputnjak, of which it is a part, and Hreljin, to the southeast, into one continuous built-up area along the dolomite zone. Not only did the center of settlement move higher up the slope, from Dolac to the new road, but the former house type was replaced by pleasant stone buildings many of which have survived the ravages of the 1939–1945 war.

The short-lived economic prosperity had faded by 1862 with the capture of the trade of Bakar and Rijeka by

the progressive port of Trieste which was, in that year, linked by rail to Zagreb. The carriers of Praputnjak gradually declined in number and, although the completion of the Zagreb-Rijeka railway in 1873 greatly increased Rijeka's significance, it did not rehabilitate Praputnjak. The importance of this loss of income to the village was emphasized by the decline in agriculture that had occurred during the intervening years. The final blow was the widespread destruction of the all-important vine by phylloxera about 1895. In response to the new economic conditions the trickle of overseas emigration of earlier years was swollen into a turbulent stream. Most of the emigrants were males and their departure left the population structure of the village unbalanced, a factor of importance in view of the lack of attempts to rejuvenate the vineyards by methods proved possible, for example, in the neighboring Vinodol.[14]

In 1880 the population of Praputnjak totaled approximately 1000; the number today represents only 47.6 per cent of the 1880 population. During the 70-year period the decline was sharpest between 1880 and 1910 when over 60 per cent of the total decrease occurred. Since 1910 the decline has been slower, as fewer opportunities for migration overseas have existed and as the economy has become adjusted to the new conditions. Nevertheless, a decline continues with a movement of people to other parts of Yugoslavia. The unbalanced sex structure was marked during the early years; in 1880, 57.5 per cent of the inhabitants were females and by 1890 the percentage had risen to 64.5 per cent. At the same time the number of households decreased. One by one houses were abandoned. The village became smaller in population and in area.

In spite of emigration, decrease in population, and fall in number of households, the average area of land per family did not increase. With the abandonment of land the holdings became smaller and the family economy more dependent on wage-earning both locally and abroad. The change in the social structure of the village went hand in hand with the gradual loss of its agricultural character.

The agricultural decline was clearly illustrated in the landscape and most of the features are still visible today. Elaborate terraces for vines lay unused. The terraces themselves began to crumble. Weeds and scrub invaded pasture, meadow, and arable land. The landscape was indicative of a forsaken agriculture. Only near the village were a few small strips cultivated. Once forsaken, the care and attention of centuries soon succumbed to nature and the natural poverty of the area reasserted itself. The stringent physical conditions made a return to former production impossible without careful planning, combined work, a large amount of labor, and the investment of considerable sums of money, none of which were readily available.

PRAPUTNJAK TODAY

Most of the village land is located on the planina[15] where, before the agricultural decline, the peasants pastured their animals and cultivated potatoes, cabbages, and other crops. Later the planina came to serve only as pasturing grounds and its significance has been further reduced with the

[14] In the Vinodol the disease was successfully combated by grafting local varieties of vine to disease-resistant American stock and by regular spraying with copper sulphate.

[15] The Slavic word *planina* applies specifically to long flattened crests, apparently relics of eroded surfaces of the Karst. The word is used here in a wider sense to cover the Karst in general.

decline in livestock numbers. Today, only three families are fully engaged in grazing. All the others are dependent on a mixed economy of industry, trade, and agriculture and the last of these is now merely a supplement to the basis of livelihood, namely, wage employment in urban centers.

Immediately before the 1939–1945 war the village land carried 150 cows and 300–400 sheep; today there are barely 45 cows, 200 sheep, and 100 goats. The cows and goats are divided amongst a large number of peasants while nearly all the sheep are owned by three families and it is the latter who retain the last traces of the widespread pastoral traditions of former years.

Only sheep farming retains elements of transhumance. From March to October the flocks are put out to pasture. They are on the planina for most of the time after which they are brought down again to the village. At the beginning of the season, in March and April, they are grazed near the village on all the uncultivated land and during this lambing period the owner carefully shepherds them. During April and thereafter, when the arable crops are in growth and liable to destruction by uncontrolled grazing, the flocks are moved further inland onto pastures which were communally owned before 1939 but are now under State control. Generally, pasture under forest is preferred because of the more nutritious grasses and the greater milk yield therefrom. On their return in October after the harvest, the sheep are again grazed on the land near the village until the threat of strong winds and cold weather necessitates hand feeding in stables.

During the period on the planina pastures the sheep are concentrated and grazed together. At first they are moved far afield to forest pastures between Lič and Bribir until brought back to the village pastures on the planina after the hay crop has been harvested. Here they remain until the final movement down to the village. While the flocks are on the upland pastures the whole life of the three households is predominantly occupied with them and to a lesser extent with arable cultivation around the village. No member is engaged in other work at this time and all income is derived from animal products. From the milk of the sheep, cheese is made on the planina and brought down to the village where it is preserved in wooden, brine-filled barrels until sold to other peasants or, in the following summer, to coastal tourist resorts. There is continual movement up and down between the village and the planina. Every third day mules bring food up to the shepherds living on the planina and return with cheeses and hay to the village. However, these are features more of the past than of the present.

Goats form a new feature of the pastoral economy and are grazed on pastures near the village or fed on grass brought down from the planina. During the harvest season from September to November they are gathered together and carefully controlled to prevent the destruction of crops. Their milk is solely for domestic use. Cows form another important livestock element and are stabled for nearly all the year while being hand-fed on grass and hay from the planina. Only rarely are they put out onto pastures which are always near the village. Before the 1939–1945 war, cows were included in the seasonal movement which is now restricted to sheep. Part of the milk is sold within the village, but the bulk of production is sold to the coastal settlements. Despite the value of milk as a source of

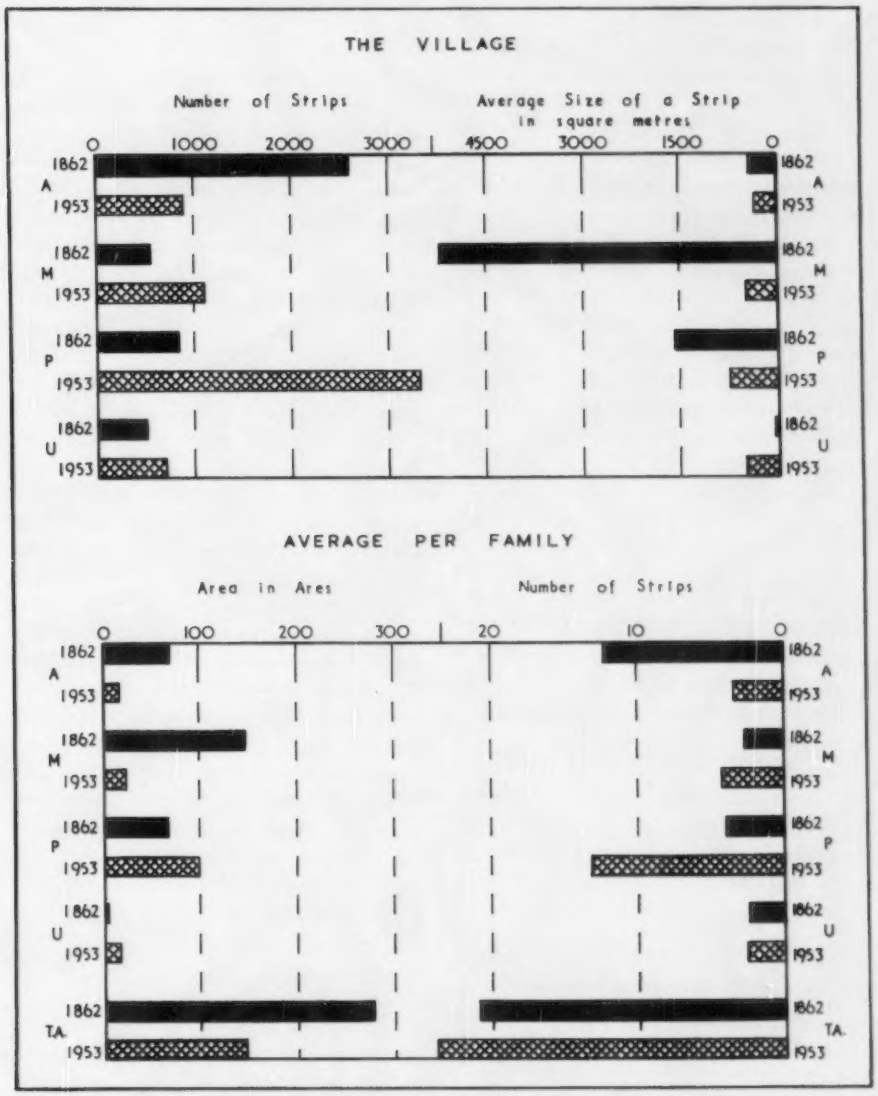

FIG. 6. Changes in land use for Praputnjak 1862–1953: A, Arable land; M, Meadow; P, Pasture; U, Unproductive; T.A., Total area. (N.B. Land in forest is excluded).

income no family supports more than three cows, a reflection of the dominance of non-agricultural pursuits.

The reorientation of peasant agriculture in Praputnjak is illustrated by a comparison of statistics for 1862 and 1953 (Fig. 6). During the 90-year period, arable land and meadow have decreased. Within this broad grouping the most striking decline is in the area devoted to vineyards. Pasture now occupies a greater area than formerly

while the abandonment of poorer land and distant strips is shown in the increased area classified as unproductive land. Equally illuminating are the changes in the number and size of strips for the village as a whole. During the period a marked decrease in the number of arable strips has occurred along with a slight decline in the average area of a strip. This is a clear indication of the neglect of arable cultivation which was the key to the former subsistence economy. All the other land categories show increases in the number of strips, with that of pasture most notable. With the exception of unproductive land there has been a substantial fall in the average size of a strip, a reflection of increased subdivision of holdings. Indeed, from 1862 to 1953 the average size of holding (excluding forest) has fallen from two and three quarter hectares to less than one and a half hectares. A detailed analysis of various land types available for each family in 1862 and 1953 emphasizes the transformation. The arable area has declined by 75 per cent while meadows occupied only one-fifth of a hectare in 1953 as opposed to one and a half hectares in 1862. Equally significant is the increase in number of strips with the exception of those classified as arable.

These features of agricultural change can be found in varying degree from one part of Hrvatsko Primorje to another.[16] They are representative of the processes at work throughout the Karst region and illustrate the nature of many of the problems that make southwest Croatia an area of agricultural recession.

[16] See W. B. Johnston and I. Crkvenčić: "Changing Peasant Agriculture in Northwestern Hrvatsko Primorje, Yugoslavia," *Geogr. Rev.*, Vol. 44, 1954, pp. 352–372; and W. B. Johnston: "Part III Agriculture," in *The N.W. Primorje of Jugoslavia*, edited by A. E. Moodie, Nottingham, 1952, pp. 28–46.

HRVATSKO ZAGORJE: REGIONAL SETTING

The northwestern hill country of the Danubian Basin has favored the development of cattle breeding based on fodder crops of which maize is the most important. To the east, on the broad plains of northeast Croatia, wheat is a more common crop. Along with the change in farming type from west to east there is also a significant increase in the average farm size. The agricultural differences are largely a reflection of dissimilar physical conditions, but the variation in farm size is also a response to the political events and internal migrations of people that accompanied the Turkish invasions.[17] When the Turks conquered Bosnia at the end of the fifteenth century there was a partial retreat of the Croat population into the protective hill country in the northwest of the Danubian Basin. As a result of the long period of peaceful settlement the northwestern hill country became densely populated. On the other hand the eastern plains remained sparsely settled during the long periods of political uncertainty and economic insecurity that accompanied the Turkish occupation. It was not until the end of the seventeenth century, after the retreat of the Turks south of the Sava River, that people began to return and settle the eastern plains.

North of the Sava-Danube line, the land of Croatia is of low elevation and, in the east, often monotonously flat. However, in the west, between the flood plains of the Drava and Sava Rivers, the land merges into a clearly defined divide of hill country that rises to an altitude of over 1000 metres near Zagreb. This is Hrvatsko Zagorje and forms part of the Danubian Basin.

[17] See J. Cvijic: *La Péninsule Balkanique*, Paris, 1918, pp. 112–152.

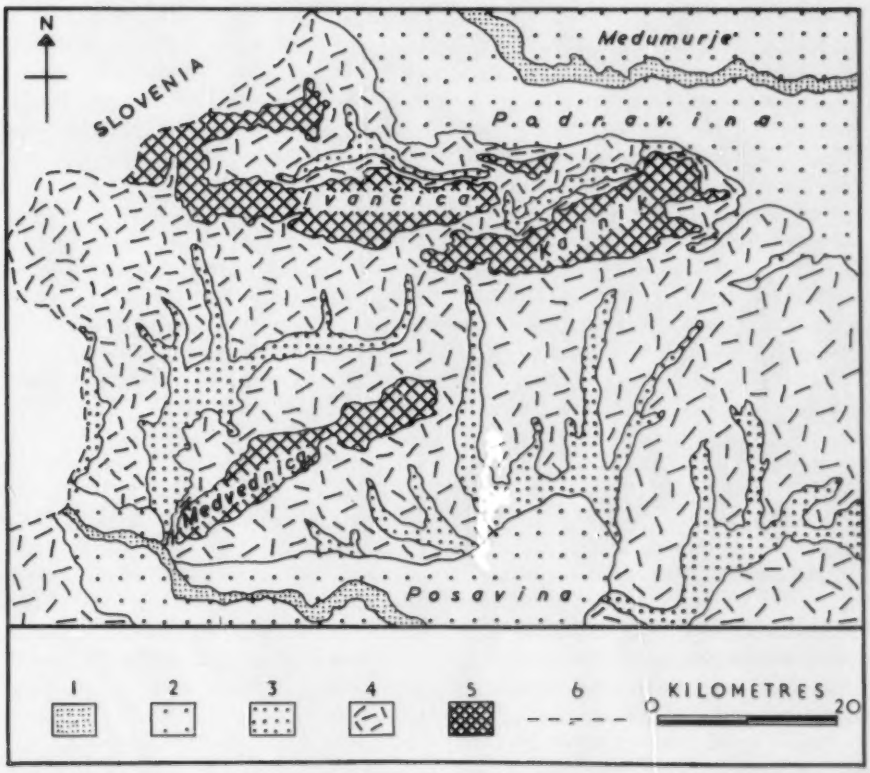

FIG. 7. Northwestern hill country of Danubian Basin—Hrvatsko Zagorje: 1. Braided stream bed, swampy with no settlement; 2. Flood plains and alluvial terraces, mostly cultivated but with little settlement; 3. Interior river valleys, swampy with meadow but with very little settlement; 4. Tertiary foothills, largely deforested, intensively cultivated, and with dense settlement; 5. Forested mountain ranges with pre-Tertiary cores of crystalline or calcareous rocks with no settlement; 6. Boundary between Croatia and Slovenia.

Hrvatsko Zagorje marks the meeting place of Dinaric and Alpine trend lines. The recent and strong tectonic movements, which broke the hill country into a series of upland blocks, were accompanied and followed by intensive erosion which has removed a large part of the Tertiary sediments to expose cores of older and harder rocks. The latter form prominent features, notably the long, steep, mountain ranges of Ivančica (1061 metres), Medvednica (1035 metres) and Kalnik (643 metres) which separate two depressions, a northern one draining into the Drava River and a southern one draining into the Sava River. Between the upstanding ranges and the flat alluvial floors of the depressions lies an extensive foothill zone averaging 250 metres in altitude (Fig. 7).

The absence of terraces along the steep slopes of the ranges makes them unsuitable for settlement and for cultivation. They remain forested. The valley floors are equally unsuitable for settlement. With their flat surface, gentle gradient, and poor drainage, they suffer extensive flooding during spring and autumn rains. They are used

almost entirely for meadows. The best natural conditions exist in the foothill zone which is, on the average, about 50 metres above the valley floor. This intermediate belt is composed of soft Tertiary sands, clays, loams and marls. The whole area receives ample rainfall —more than 900 mm. per year—and numerous springs rise along the upper margins. From the springs flow a large number of small streams which have shaped the characteristic ribbed surface form of the hill country.

The region of Hrvatsko Zagorje lies to the west of the Zagreb-Budapest railway where it traverses the hill country. Within this area, which is now one of the most densely populated in Yugoslavia, the foothills attracted the early inhabitants and still contain the foremost centers of settlement and production. Today, over much of Hrvatsko Zagorje there are more than 400 persons per square kilometre of cultivated land. The numerous villages are scattered over a wide area which is served by a poor network of communications despite the proximity of the region to Zagreb, the second largest city in Yugoslavia.

The present landscape is the result of a gradual process of clearing the forest. The colonization and development of the region has however been considerably affected by historical events and distinct phases of occupance can be recognized. The first notable one was the growth of colonization during the fifteenth and sixteenth centuries. Protected by the Medvednica-Kalnik mountain barrier, the region provided a relatively safe retreat from the Turkish attacks and received many of the Croat refugees from Bosnia. The wave of colonization appears to have been rapid and by the middle of the sixteenth century most of the present villages had been established. Included amongst the migrants were feudal lords who acquired most of the land which, in turn, was given to the peasants to cultivate in return for money, goods, and service. Because of the continued threat of Turkish advances towards Hrvatsko Zagorje, which was the most important part of unoccupied Croatia, the peasants were placed under heavy feudal obligations one of which was to organize means of defense. Under these conditions the traditional collective household (zadruga) was the most suitable unit and became the dominant economic and social form. The establishment of zadruga was also favored by the feudal lord who was interested in grouping the peasants in scattered and isolated centers in order to prevent combined resistance against his demands. In addition to the collective structure of peasant life, the hilly character of the country influenced the form of villages and their distribution.[18] The zadruga thus became the key feature in settlement and the dominant element in economic organization.

In Hrvatsko Zagorje the zadruga was known as *skupčina* ("collective property") all the members of which were not necessarily related while the number of members varied with the size of the property. The leader was not the "father of the family" but an elected master. The skupčina was founded on a territorial principle whereby each organized group was associated with a particular area and only secondarily

[18] In Hrvatsko Zagorje the characteristic form of the "village" was that associated with isolated collective farms the lands of which were enclosed and gathered around the farmhouses. This *einödflur* type of settlement was dominant in Hrvatsko Primorje from at least the sixteenth until the middle of the nineteenth century. The village analyzed—that of Slanje —occupies a transitional position between Hrvatsko Zagorje and Podravina. It was essentially a nucleated village and had only gardens and orchards gathered around the farmhouses while the land was managed on an open field system.

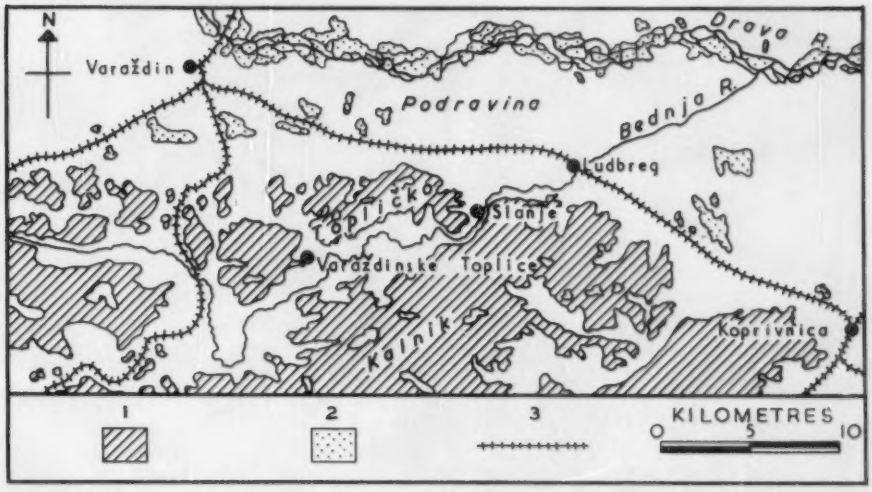

FIG. 8. Slanje area of Hrvatsko Zagorje: 1. Wooded areas on hill country; 2. Wooded areas on plain; 3. Railway.

by family ties. The prime aim of a skupčina was self-sufficiency and, thus, it was theoretically possible for each to function as an independent economic body. It was common, however, for several zadruga to share a common pasture given to them by the feudal lord and, in addition, the forests provided a common source of timber. Agriculture was extensive in character with pastures occupying the largest productive area. Nevertheless, a zadruga was a separate unit and, as the members lived together in a group of buildings, each formed a "village".

The abolition of serfdom after 1848 occurred in an era of general economic progress which was marked by the growth of towns, the construction of roads and railways, and the beginning of industrialization. The new-won freedom and the possibilities of new employment were two important factors encouraging the break-up of the zadruga into individual households. Another consequence was that the lands of the zadruga which were concentrated around the settlements were divided amongst the families. The change was further accentuated by the system of inheritance whereby all male children and, frequently, unmarried daughters received equal shares of the father's estate. These dynamic forces effected changes in the form of villages, in social structure, in agricultural development, and in the organization of the separate parts of an individual holding.[19]

SLANJE: THE DECLINE OF THE ZADRUGA

The village of Slanje is situated at the point where the Bednja River, a right bank tributary of the Drava, flows out from the hill country of Hrvatsko Zagorje into Podravina, the broad and flat valley of the Drava (Fig. 8). By cutting into the ridges of the Kalnik range on its right side, Bednja River has developed an asymmetrical valley. The right bank rises sharply into the steep ridges of Kalnik

[19] See I. Crkvenčić: "O Agrarnoj Strukturi Gornjeg Porječja Bednje," *Geografski Glasnik*, Vol. 13, 1951, pp. 101–114; (with French summary, "Structure agraire de la vallée supérieure de la Bednja," p. 115).

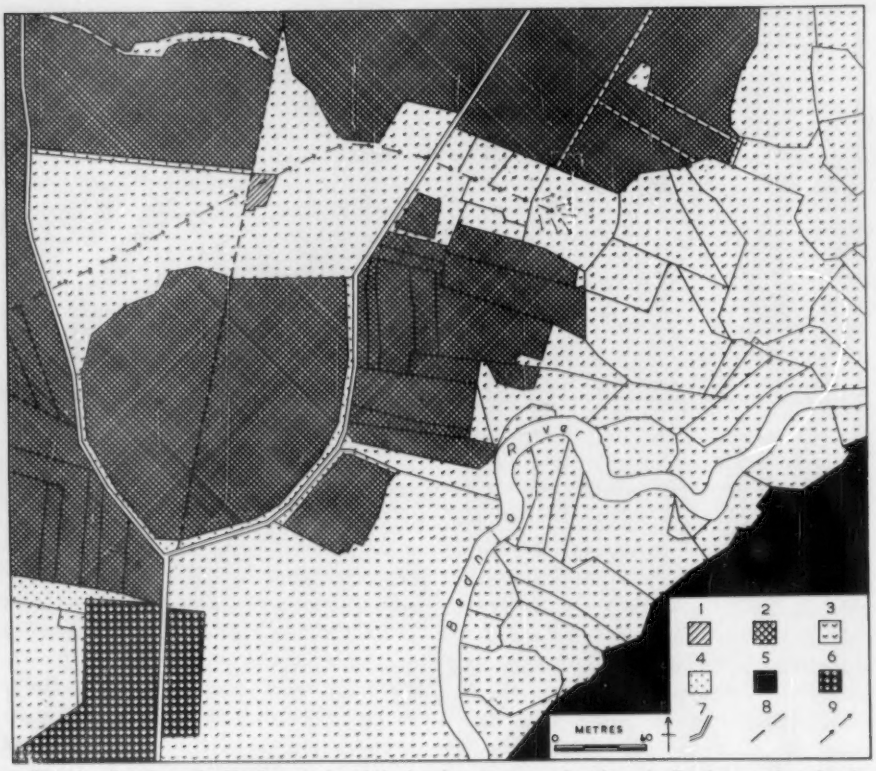

FIG. 9. Land use in Slanje area in 1860 showing pattern of strips: 1. Gardens and orchards; 2. Other arable land; 3. Meadow; 4. Pasture; 5. Forest; 6. Northern part of Slanje village; 7. Road; 8. Footpath; 9. Drainage channel.

which is here formed of Pliocene materials and completely covered in forest. The left bank passes gently into the hills of the low Topličko range which rises to about 360 metres in altitude. Within this gradual slope there are two terraces; the first and lower one is eight metres above the river while the second is thirty metres high. Clays and loams form the terraces both of which are dissected by numerous small streams although this feature is most marked on the higher one.

Between the river and the eight metre terrace is a narrow flood plain about half a kilometre in width. Because of seasonal flooding during the heavy spring and autumn rains the flood plain is meadowland. This is the richest land and the meadows provide excellent hay which is cut as often as thrice a year depending on the severity of flooding. Along the line of contact between the two terraces runs a road connecting the district town of Ludbreg and the mineral spa of Varadžinske Toplice. The arable fields stretch along both sides of the road but are limited to the terraces, which have a podsolized soil of low fertility. The higher slopes of the hills consist of harder material of Pliocene age. Here, in clearings within the forest, are the principal vineyards (Fig. 11).

The present character of the village

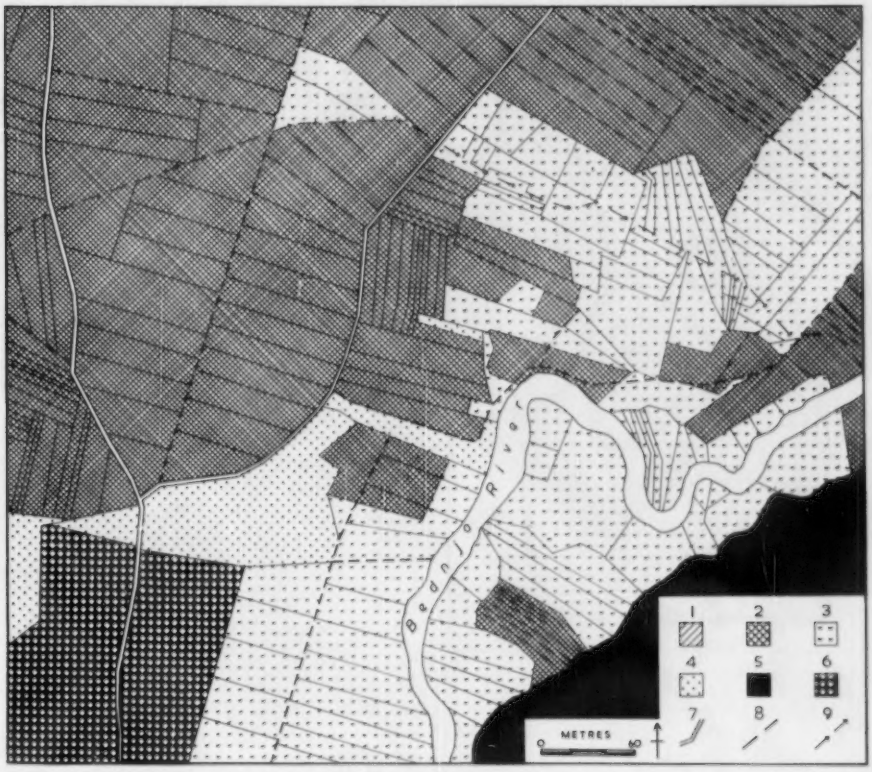

FIG. 10. Land use in Slanje area in 1914 showing pattern of strips (same area as in Fig. 9): 1. Gardens and orchards; 2. Other arable land; 3. Meadow; 4. Pasture; 5. Forest; 6. Northern part of Slanje village; 7. Road; 8. Footpath; 9. Drainage channel.

is relatively very young and its development incomplete. The cadastral map of 1860 shows that most of the buildings of the zadruga were concentrated on the higher terrace. A few were on the lower one, but they were all on the western side of the road. The form of the village today is strikingly different and reflects the changed social and economic organization which entered a new stage of development after the abolition of serfdom in 1848.

The collective economy of the zadruga was the fundamental feature of peasant agrarian organization in feudal times. The obligation of the peasants to meet feudal dues of money, goods, and services made the zadruga a vital feature for, with no other avenues of employment available, it at least allowed them to discharge their duties and gain a living.

In the latter half of the nineteenth century, however, new economic forces came into play as evidenced by the beginning of industries, new forms of transport, and the growth of towns. The peasant now found other means of livelihood available to him; membership of a zadruga was no longer indispensable. Other factors contributed to the process. By 1895 almost 90 per cent of the vineyards of Slanje had been destroyed by phylloxera. Their de-

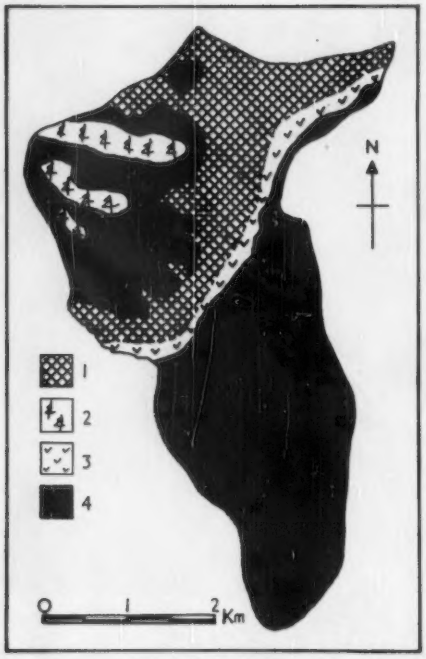

FIG. 11. Generalized land use of Slanje village lands: 1. Arable land; 2. Vineyards; 3. Meadow; 4. Forest.

struction, however, was not as significant as in Hrvatsko Primorje for the vine was less important in the agricultural economy. Nevertheless the disease was of consequence, since all varieties of vines suffered deterioration and, therefore, the new individual households were unable to find local replacements for the higher producing varieties that also had been killed.

In the second half of the nineteenth century there began the rapid growth of local industries such as sawmills, flourmills, and starch factories which were soon employing 400 men, mainly from Slanje. Within the village, factories and offices were built and a tramway was constructed to transport timber from the forest. The industrial development at Slanje was amongst the greatest in Hrvatsko Zagorje at that time but it failed to maintain its position when, towards the end of the nineteenth century, railway development attracted industry and encouraged the growth of towns, such as Varaždin and Koprivnica, at focal points in the modern communication pattern. The industrial boom in Slanje was short lived, and by the end of the first decade of the twentieth century it was over. Although with the rapid passing of the industrial phase the village was once again completely agricultural, the short period had profoundly affected village life and society.

With the abandonment of the zadruga, the peasant estates were subdivided into individual small farms (Figs. 9 and 10). The farm strips which had been relatively concentrated under the zadruga now became scattered in distribution and smaller in area. In practice, cultivation became more difficult and less economic. The break-up of the zadruga also affected the form of the village as the smaller family unit had different needs from those of the larger community. The extensive yards of the zadruga gave way to smaller ones and the buildings were rearranged to suit the needs of the individual family.

The buildings of the collective household were freely arranged to fit the site but, in general, the house was the center around which were located all the other functional buildings, including the smaller house for the younger members of the "family" and the barns and stables. With the advent of individual households the buildings required by each family were fewer in number and smaller in size and were often built on the large open space of the former yards of the zadruga (Figs. 12 and 13).

The old village was situated on the higher terrace along tracks which ran at right angles to the main road. To

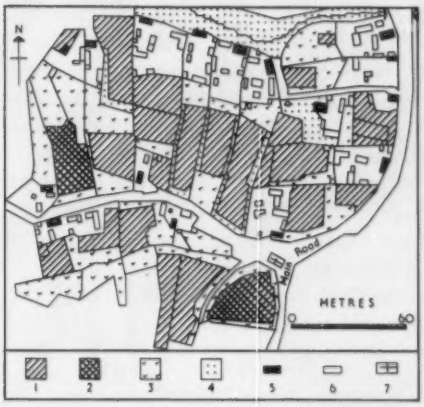

FIG. 12. Land use of a section of Slanje village in 1860: 1. Orchards and gardens; 2. Other arable land; 3. Meadow; 4. Pasture; 5. Dwelling; 6. Other buildings; 7. Church.

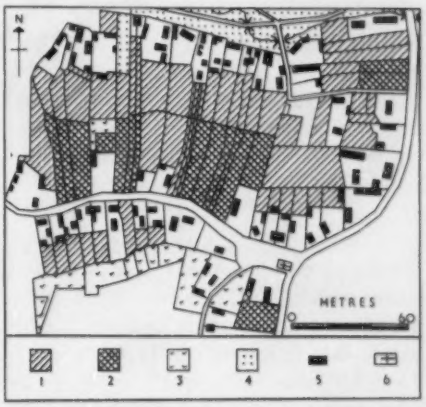

FIG. 13. Land use of a section of Slanje village in 1914 (same area as in Fig. 12): 1. Orchards and gardens; 2. Other arable; 3. Meadow; 4. Pasture; 5. Buildings; 6. Church.

the east of the road, building was prevented by the feudal control of land which persisted until the postwar reforms of 1919. Since then houses and farm buildings have descended onto the lower terrace to the east of the main road and, thus, the present *strassendorf*[20] form of the village has evolved. The very slow development of the new form of the village reflects the limited economic resources of the peasants. Another change was in the building materials, bricks replacing timber.

The fluctuations in economic conditions were accompanied by changes in population numbers. During the second half of the nineteenth century growth was very rapid; between 1880 and 1900 the population rose almost 50 per cent from 725 to 1075. The year 1900 marks a turning point. With the decline of local industries and the failure of nearby sources of wage employment some emigration occurred. The population of Slanje ceased to increase and then began to decline, reaching 1000 in 1931. Since then the trend has been reversed and the steady increase has almost balanced the loss during the early decades of this century.

The division of feudal estates, dispersal of strips, and the effects of the earlier increase in population necessitated an extension of arable land in addition to the areas acquired by the agrarian reforms of 1919. This was shown in 1937 by the individualization of communal forests many of which were soon cleared and cropped. The post-1919 era was generally a difficult one for the peasants. The land obtained in 1919 had to be paid for. Frequently the peasants were forced to borrow from banks and a large number were constantly in debt. During these years many of the peasants sought freedom in the eastern districts where land was cheaper.

An important source of income during these years was from trade in forest products, including an edible fungus and other medicinal plants. In addition, Slanje was able to capitalize on its favorable location on the border of two contrasting regions, the exclusively agricultural Podravina and the

[20] In the *strassendorf* form of village, farmsteads face each other across a road which existed before the settlement.

hill country of Hrvatsko Zagorje with its forests and vineyards. The village assumed an entrepreneurial role by which its inhabitants prospered. Wine was sold or exchanged for grain while timber was transported to district towns such as Varaždin and Ludbreg.

SLANJE TODAY

Agriculture, in which cropping and cattle-rearing are the two main components, is the present basis of life in Slanje but it is not highly specialized. The holdings are small and strips scattered; rentable land is not available and agricultural products are varied in character.

The 90 years between 1860 and 1953 have resulted in agricultural changes that are significantly different in many ways from those observed at Praputnjak (Fig. 14). The most striking feature is an increase in the arable land of the village by more than 80 per cent. During the same period the number of strips has increased, notably of arable land, along with significant decreases in the average size of strips. The statistics for average areas of various land categories for each family in Slanje in 1860 and 1953 reveal further major changes. The average size of holding (excluding forest) has decreased from seven and a half hectares to slightly over two hectares. The decreases are fairly uniform for each land category.

A comparison of Figures 6 and 14 illustrates the different directions of agricultural change in Praputnjak and Slanje during the last 90 years as well as differences in the land use structure. The minute size of farms in Praputnjak is accentuated by the low productivity of the soil. In addition arable land and meadow still remain the basis of farming in Slanje whereas in Praputnjak they have decreased in area and importance in favor of pasture and unproductive land. Although detailed statistics on forests are not available there is little doubt that they would be in accord with the general trends. In any case much of the forest on the Karst is low scrub and of little value.

The nature of the agriculture of Slanje is well illustrated by a detailed farm study (Table I). The farm is nearly five hectares in size which is somewhat larger than the average for the village.

TABLE I

LAND USE ON A SLANJE FARM: HRVATSKO ZAGORJE

Land Use	*Area in*			*No. of Strips*
	ha.	*a.*	*m.*	
Arable	2	44	57	15
Gardens and Orchards	..	7	19	1
Vineyards	..	43	16	4
Meadow	..	28	77	2
Pasture	..	35	97	2
Forest	1	15	9	5
Unproductive	..	..	..	..
Total	4	74	75	29

More than 50 per cent of the total farm area is arable, 24 per cent is forest, and 13 per cent is meadow and pasture. The land use of the strips varies with the quality of the soils and the distance from the village. More than half of the arable area is in maize which is important both for human and animal consumption. This is the key crop in an economy which is organized, firstly, to meet domestic needs and, only secondly, to provide produce for sale. Next to maize, potatoes are the most important food crop. The remainder of the arable strips are largely in wheat, rye, or barley. Fodder crops such as clover and turnips are of limited significance; the former is predominantly sown as a member of a rotation system.

The use of crop rotational methods depends largely on the size of farm. On the smaller holdings red clover may be

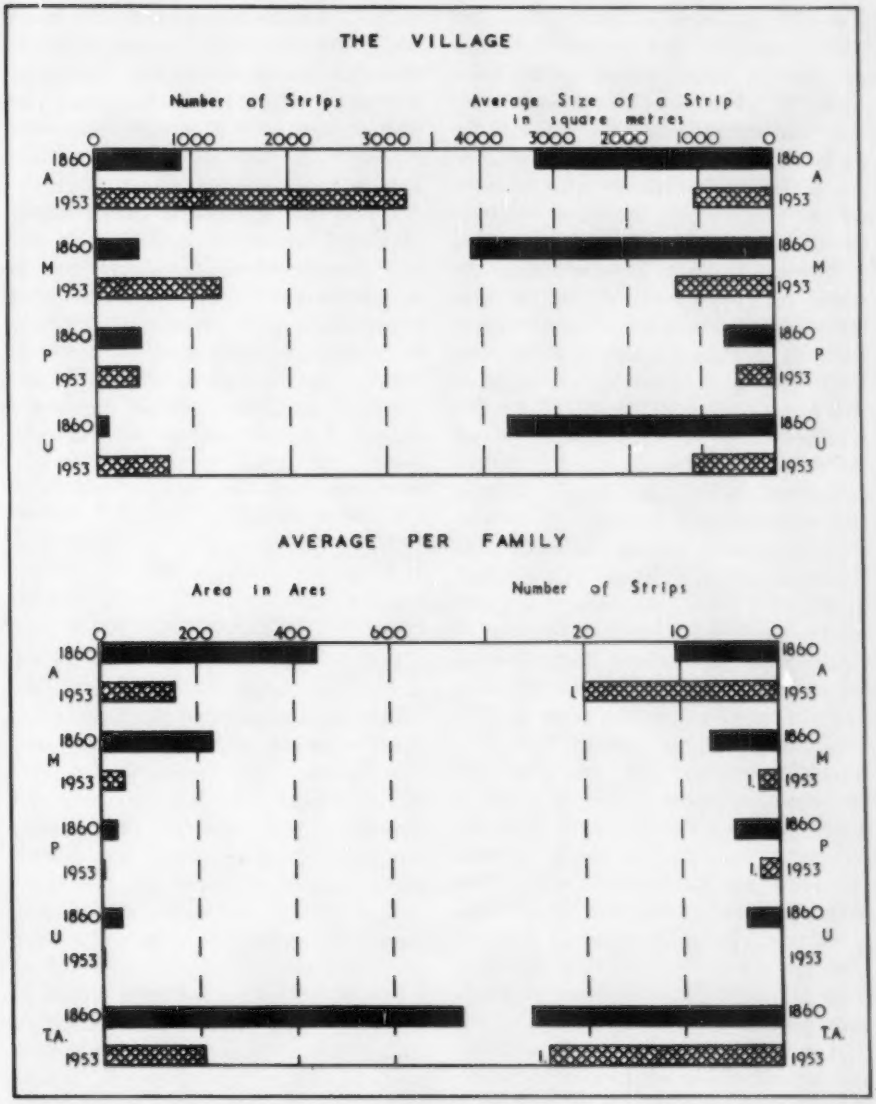

FIG. 14. Changes in land use for Slanje: 1862–1953: A. Arable land; M. Meadow; P. Pasture; U. Unproductive; T.A. Total area (N.B. Land in forest is excluded). 1. The data used in this bar is for only one farm, which is somewhat larger than the average. Full data are not available.

entirely absent or, at the most, grown for one year while on the larger farms it is replaced by lucerne for three or four years. The peasants plan a crop rotation for all arable strips because of the large number common to all farms. However, in any one season a large number of strips are always to be seen in maize. Indeed, the rotation is often directed more by immediate

economic factors than by the demands of soil fertility. Two common rotations are, firstly, maize, wheat (or rye) followed by clover for one to four years and, secondly, maize and wheat (or rye). In the former, maize is planted immediately after clover while, in the latter, the soil is manured between the harvesting of wheat and the sowing of maize. In both, however, after the wheat (or rye) harvest in the autumn, the strip may be sown with turnips or buckwheat although this is most common in the case of the second rotation. The other cultivated crops total a much smaller area. Special strips, where the crop rotation is adjusted to fit the crops and to suit the fertility of the soil, are reserved for them.

Cattle-rearing is complementary to crop cultivation. The animals are used in drawing carts, for ploughing, and for the provision of milk. The sale of cattle, especially calves, forms one of the main sources of income for the peasant although, in certain cases and in favorable years, the sale of wine may be of greater value. On the farm studied two cows, one horse, five pigs, and 20 head of poultry were carried. With this number of animals the peasant farmer cultivates all his scattered strips and each year sells off one calf or cow and a few pigs. In addition he can meet his domestic demands for most of the year. This is exceptional as most peasants must regularly buy in supplies.

Hay from the valley-floor meadows, straw, and maize stalks provide additional animal fodder. It is customary to keep the best hay for the working summer season while in winter the animals receive less nutritious feed and, as a result, the quantity of milk is lower. Grazing of the meadows is confined to autumn after the second or third cut of hay.

A common feature is for each farm to contain areas of vineyards and forest which are sufficient to meet domestic demands for wine, timber, and fuel, and to provide a surplus for sale. The wine is not of high quality but finds a ready market in the villages of Podravina.

On the particular farm lives a family of six of whom three—two men and one woman—work the fields, one is housewife, one a child, and the other a dependent grandfather. In addition to fulfilling the prime functions of meeting family needs, the farm also produces saleable surpluses in normal years. A typical postwar year may be given:

Sold off Farm	*Value in Dinars*
1,000 litres of wine	100,000
1 calf or cow and a few pigs	70,000
Timber, especially for fuel	30,000
Total farm income	200,000

Out of this income some 14,000 dinars are taken in taxes and the remainder is required to purchase household necessities and to run the farm. The income from the particular farm is not sufficient to buy anything but essentials, yet most of the peasant families of Slanje receive less income from their farms and are, therefore, obliged to seek supplementary employment. In consequence there is a tendency to leave the village in search of employment and a better standard of living. This has resulted in constant emigration which is directed primarily towards the eastern parts of Croatia where the capital acquired from the sale of their village holdings is frequently sufficient to enable the migrants to buy a farm substantially larger and equally, if not more, productive.

CONCLUSION

The Republic of Croatia, like the rest of Yugoslavia, remains a country of

peasant farmers. Agricultural changes are therefore of wide and basic significance. Within Croatia the decline in cultivated area during the twentieth century is a noteworthy feature that deserves detailed study.

Underlying the broad distinction that has been drawn in Croatia between the advancing agriculture of the Danubian Basin and the retreating frontier of the Karst is the contrasting physical character of the two regions. But this in itself is an insufficient explanation as becomes readily apparent on examination of the history of land use. The sample studies of the landscape and economy of a village in each region have indicated some of the operative factors. In both cases, however, the dominant long-term process is the growing impact of a money economy which has disrupted the former agricultural way of life. In Praputnjak the disruption amounts to a transformation. Village life has been reoriented away from the land towards the demands of the industries, tourists, and permanent urban populations of the coastal towns. The peasantry has here become a proletariat. On the other hand, in Slanje, agriculture remains prosperous although pressure on land has resulted in a movement of population to areas that are less densely settled.

The two examples do have general applications. Nevertheless, the picture must remain incomplete until further studies in different areas of Croatia have been made. As commercial incentives penetrate more deeply, further changes are to be expected in regional economies. And as the regional economy changes so will the regional landscape which is a product of the aims of production and the methods used to achieve those aims.

LAND USE AT SOBA, ZARIA PROVINCE, NORTHERN NIGERIA

R. Mansell Prothero

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TO the writer's knowledge there has been no published analysis of the land use pattern in a Hausa village in Northern Nigeria. The only account available is that of the hamlet of Gata included in the report of the Anchau Rural Development Scheme.[1] Though the features described here are those found in Soba village they are typical of the remainder of north Zaria Province and are, to a very large extent, characteristic of the southern parts of Hausaland with their low-medium population densities contrasting with the high density areas of Kano, Katsina, and Sokoto Provinces farther to the north.

Soba is a large village[2] in the predominantly Hausa-speaking area of north Zaria Province. It lies 22 miles east of Zaria City on a dry-season road which runs eastwards to join the main Kaduna-Jos road at Pambeguwa. Half a mile to the north of the village runs the light railway from Zaria to Jos and Soba has a station on this line (see Fig. 1).

The survey was confined particularly to the farmlands of Soba village with observations made in the outlying hamlets for comparative purposes.[3]

[1] T. A. M. Nash: "The Anchau Rural Development and Settlement Scheme," H.M.S.O., 1948.

[2] The 1952 Population Census of the Northern Region recorded a total of 4124 persons in the Soba Village Area, which includes all the outlying hamlets some of which are not included in this survey.

Categories of Land Use

The following were recognized for the purpose of the survey (see Fig. 2).

i. Land under cultivation.

ii. Land that had recently reverted to fallow after cultivation—probably during the previous one to two years.

iii. Fallow land of greater age—probably from three to five years out of cultivation.

iv. Heavy bush in which the density of growth was variable but where everywhere there had obviously been no interference with the cover for some considerable time.

Informants spoke of fallows of 30 years' duration, and a great deal of land in this category had undoubtedly not been cleared for from 15 to 20 years. In character it approximates very closely to the northern type Guinea Savannah in Nigeria[4] with its tall grasses and a predominance of Doka Woodland (*Isoberlina doka*).

In this and the earlier categories various species of trees are found, the most frequent being those of great economic value, particularly the shea-butter tree (*Butyrospermum parkii*) and the West African Locust Bean tree (*Parkia oliveri*). The number of trees occurring in the farmlands is very variable but certainly does not attain

[3] The methods of survey used have been discussed in a separate paper.

[4] D. R. Rosevear in Chapter 15, "Vegetation," *The Nigeria Handbook*, 1953, pp. 160–165.

the recommended average of six trees to the acre, to provide shade for growing crops and leaf-mould to build-up and maintain humus in the soil.

v. "Fadamma," river flood plain which is seasonally innundated and in the case of the large rivers receives an annual addition of silt which assists in maintaining its fertility. In the vicinity of Soba the streams[5] diverge in a radial pattern on a gently rolling surface forming part of the great area of the "high plains of Hausaland" (average height 2000 feet above sea level). They are slightly incised suggesting a recent rejuvenation, and their former flood plains are no longer innundated during the wet season but become water-logged. The importance of the moisture supply remaining in this soil during the succeeding dry season will be discussed later.

[5] They are minor tributaries of the River Galma (itself a tributary of the Kaduna River) whose course describes a great northward loop in the north of Zaria Province. The river takes its name from the resemblance of this loop to the large hoe (Hausa, "galma") used in Zaria Province.

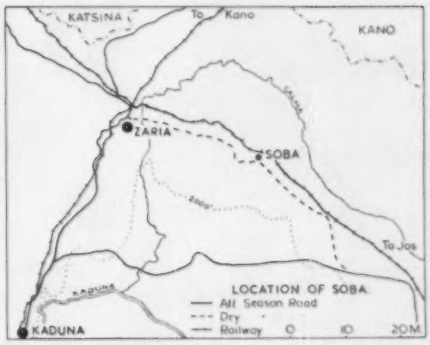

FIG. 1.

The main "fadamma" area utilized, not amounting to many acres, is along the Jamana stream particularly where it flows through Soba village.

PATTERN OF LAND USE

The main concentration of the first three categories is within a radius of one to one and a half miles of the village (within half a mile to the south of the village). Outside of this the heavy bush predominates with scattered but sizable tracts of cultivated and fallow land.

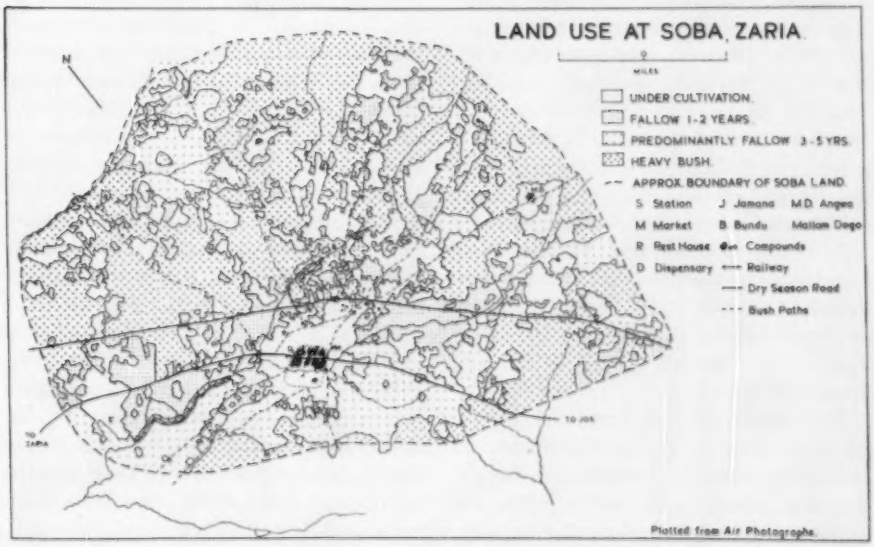

FIG. 2.

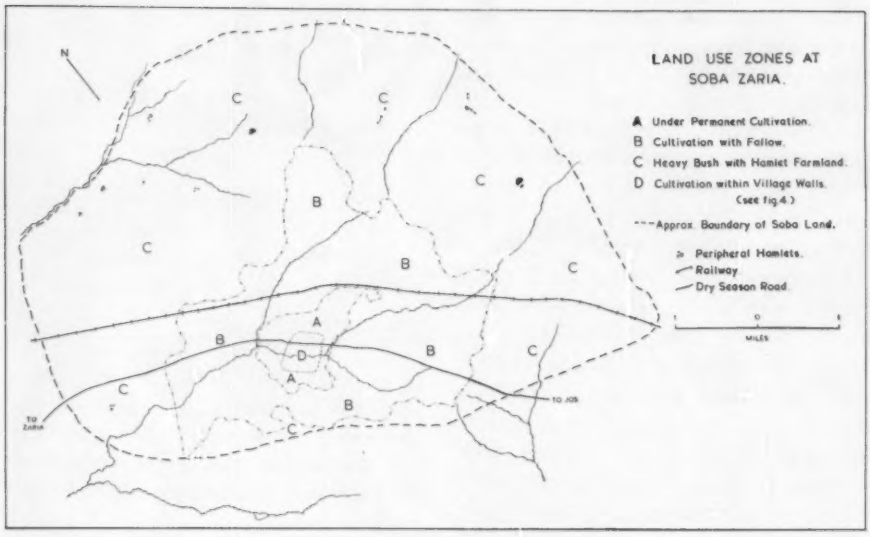

FIG. 3.

Many of these are associated with a series of hamlets at a distance of about three to three and a half miles to the north, northeast, northwest, and southwest of the main village.

Outside of the walls of the village the land can be divided into three broad, largely concentric zones, best developed on the north, west, and east where the greater part of the village land is located (see Fig. 3).

A. An area of almost unbroken cultivated land immediately outside the village and extending up to a maximum distance of a half to three quarters of a mile from the village walls. Small patches of fallow do occur and there are areas of non-agricultural land, as for example around the market and rest house and dispensary, but they are of no significance.

This zone is under continuous cultivation, its fertility being maintained by manuring with the droppings of horses, donkeys, sheep, and goats kept in the village; and from Fulani cattle which are kraaled on the land after the harvest when they are being trekked southwards through this area to the southeast of Zaria Province and the area around Kafanchan on the western borders of Plateau Province in search of dry season pastures. The cattle feed off the guinea corn stalks (which ratoon well on into the dry season) and leaves which remain on the land. A payment of a small amount of corn may be made by the farmer to the Fulani herder. Household sweepings and other village refuse are also used as manure but none of this is composted.

This system of fertility maintenance on a restricted area of land is common throughout the greater part of Northern Nigeria and demonstrates that the land can be kept in good heart provided that manure is available. It is difficult to estimate the amount that is applied but the experiments carried out by the Department of Agriculture have shown that dressings of one to two tons per acre can have remarkable results.[6] The system however is not entirely satis-

[6] T. A. M. Nash, *op. cit.*, p. 16.

factory. The manure is distributed in a very haphazard fashion and is not dug into the land until cultivation commences several months after it has been put down. During the intervening period it has been subjected to the heat and dessication of the dry season. Proper methods of composting (encouraged and demonstrated by the Department of Agriculture) would do much to increase the value of the manure at present available. The possibilities for increasing the amount of manure in the Soba area under present conditions are not very great owing to the incidence of trypanosomiasis. It was reported that the District Head at Soba ten years ago tried unsuccessfully to keep cattle.

B. In a zone from a half to one mile in width cultivation is carried on a system of land rotation. Farms are cleared and cultivated for three to four years and then the land reverts to fallow for a period of at least five years. All the cultivable land in this zone is cultivated within a period of ten years. The length of time that a piece of land has been under fallow can be judged relatively by the size and density of the bush; more accurately it can be determined by the composition of the vegetation.

The efficiency of this system in preserving fertility and maintaining crop yields has to be acknowledged. With ample land available (and this fact was emphasized without exception by the local people) it can be assumed that if fertility were not maintained at a reasonable level for the three or four years of cultivation then the period would be reduced in length. There was, however, evidence of a falling off in the condition of crops planted in the third and fourth year. This is due to the inevitable reduction in fertility but also to an apparent reduction in the care taken in cultivation. The ridges that are made for planting at the beginning of the farming season are much reduced by erosion under the heavy rains particularly at the commencement and the end of the wet season. Often after the early rains they have to be rebuilt. By the end of the farming season after the rains have ceased and the harvest completed the ridges will probably be not more than one-third of their original height and the finer particles will have been washed out to form a silt deposit in the intervening furrows. The accepted practice is to make the ridges for the next year's cultivation in the previous year's furrows and so take up this silt. However, there were examples of old ridges having merely been built up again in the following season and the crops on these were poor.

C. In the outermost land use zone lying within two to three miles of the village dense bush growth is predominant. Cultivated land is made up partly of the outlying farms of people living in Soba village, but the greater part is the farmland of the peripheral hamlets. Here on a small scale, repeated for each hamlet, there is the pattern of land use which has been noted for the main village—land immediately adjacent to each settlement is kept in continuous cultivation and then surrounding it the land is farmed with intervening fallow periods.

There is an absence of heavy bush and tree growth along the stream courses, the result of clearance encouraged by the Sleeping Sickness Service in order to destroy the micro-climatic conditions favorable for the breeding of the tsetse fly.

D. The most complex and interesting of the land use zones is that within the walls of Soba village. This land can be divided into four sub-categories (see Fig. 4).

a. within the compound walls between the huts there are small patches of culti-

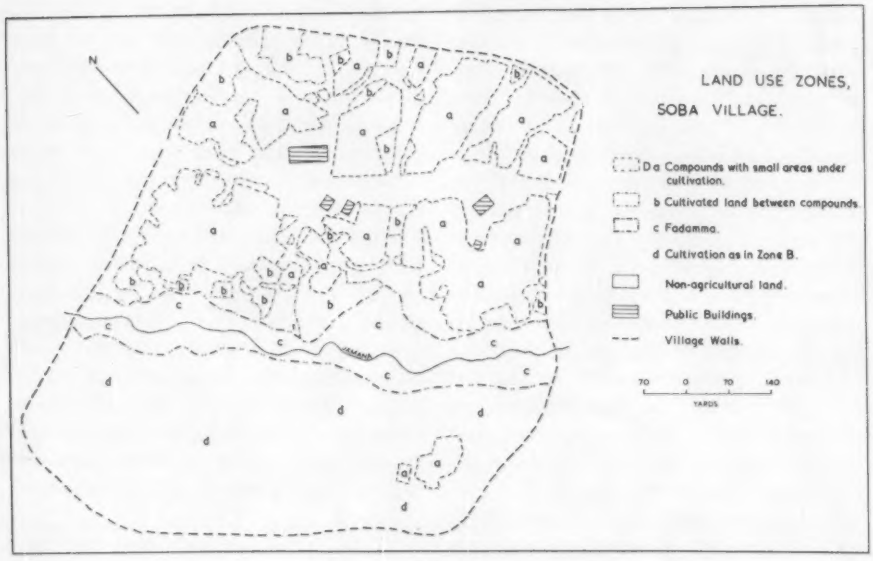

FIG. 4.

vation never more than a few square yards in area. This land is the most heavily manured and is under continuous cultivation.

b. between the compounds relatively larger areas are cultivated, from a fortieth to a tenth of an acre, and are treated similarly to those in "a."

c. alongside the Jamana stream there lies the main area of cultivated "fadamma."

d. the land to the south of the stream is farmed in a similar manner to the zone immediately surrounding the village. There is only one compound area located here at the present day though traces of former occupation are shown by the occurrence of "zogallagandi" trees (*Moringa pterygosperma*) indicating the lines of old compound fences. In some parts lateritic pan occurs at or near the surface and obviously tokens low fertility, while the grass fallows in this area suggest the need for a short resting period.

In sub-categories "a," "b" and "c" the small livestock of the village (goats, sheep, and donkeys) are allowed to wander during the periods of the year when there are no growing crops. In the case of the first two this is during the greater part of the dry season after the crops have been harvested. In the "fadamma" the additional source of moisture supply allows crop growth to continue well into the dry season. Crops are protected from damage by wandering stock by the erection of protecting fences (Hausa, "danga") three to four feet high constructed of guinea corn stalks.

CROP ZONES AND MAJOR CROPS

There is a certain amount of correlation between the land use zones and the crops cultivated though few crops are exclusive to any one zone.

It was not possible to map the whole of the zone under permanent cultivation outside the village walls but a sample area was surveyed by compass traverse (see Fig. 5). Guinea corn and cotton,

the major food and cash crops, were dominant, and the area that they occupy in the sample is roughly proportionate to that which they occupy throughout this zone. Tobacco and groundnuts (peanuts) are also grown in that order of importance. With the exception of tobacco the crops are grown on a three- or four-year rotation—cotton, guinea corn, cotton (or groundnuts), guinea corn. Groundnuts occur relatively infrequently. Soba lies well to the south of the main groundnut growing region of Northern Nigeria, though there is a groundnut buying station at which 208 tons were purchased in the 1952–53 season.

Tobacco is not grown in rotation with other crops but is cultivated continuously on manured land. This land is used in the first months of the farming season for a crop of early millet which is harvested in early August and is followed immediately by the planting out of the tobacco seedlings.

No attempt was made to map detailed crop distribution in the zone of cultivation with fallow. It was possible to obtain a fairly accurate impression from a series of sample traverses made along bush paths. Guinea corn and cotton were again predominant with relatively very much smaller amounts of groundnuts (*Arachis hypogaea*) and Bambara groundnut (*Voandzeia subterranea*). The traverses confirmed the importance of cotton in this zone. The rotation is again cotton, guinea corn, cotton (or groundnuts), guinea corn, with cotton growing well on newly cleared land and also being a satisfactory cleaning crop. Nash's report of the Gata survey[7] notes an equal amount of guinea corn and cotton grown. In the Soba farmland it can be stated with almost complete certainty that there was more land devoted to cotton than to guinea corn.

[7] T. A. M. Nash, *op. cit.*, p. 8.

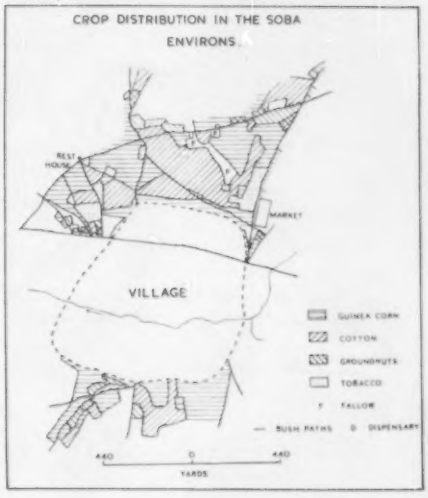

FIG. 5.

Further weight to this was given by the opinion of the Provincial Agricultural Officer that Soba was not self-supporting in basic foodstuffs. There are two possible explanations for this contrast. Gata a very small and isolated settlement by comparison with Soba would tend to ensure self-sufficiency. Soba, with the railway and the motor road, is well placed for the evacuation of cash crops and at the same time for importing food. There is also the fact of increased cotton production in recent years, the Gata survey having been made about 15 years ago.

A small area of land adjacent to one of the peripheral hamlets was surveyed (see Fig. 6). This land is kept under permanent cultivation by manuring as at Soba. Similar crops are cultivated, the interesting contrast being in the greater variety and a more marked tendency to interplant crops than at Soba. This further suggested that the smaller hamlets concentrate a greater effort on attaining self-sufficiency in their crop requirements. Groundnuts featured more prominently in the hamlet

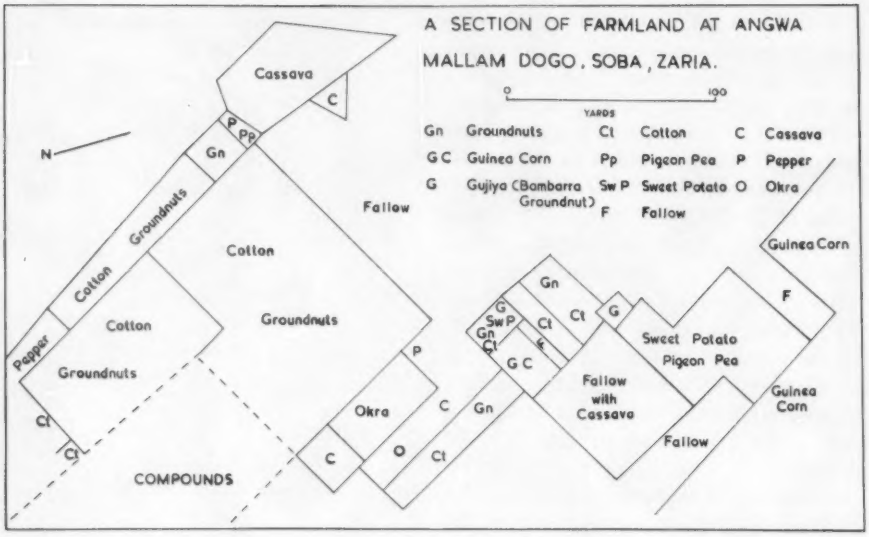

FIG. 6.

land, this possibly due to lighter soils occurring on the watershed where it is situated. Drier conditions were also suggested by some plots of ginger, a crop which grows best in light, well-drained soil and which was not observed anywhere in the farmland of Soba village.

Crop distribution within the village walls was mapped completely (see Fig. 7). The cultivated land within the compounds grows small quantities of peppers, tomatoes, okra, and rama, with invariably a few heads of guinea corn, with loofah vines trailing over the roofs of the huts and the compound walls. When these crops reach maturity they create hot and stuffy conditions favorable for the breeding of the tsetse fly by reducing air circulation in already confined spaces. This form of cultivation is therefore strongly discouraged by the Sleeping Sickness Service but it is traditional and therefore very difficult to suppress except in areas of controlled settlement development (e.g., in the Anchau "Corridor").

The somewhat larger areas under cultivation between the compounds are devoted largely to the cultivation of tobacco, with patches of guinea corn, okra, sugar cane and peppers, in that order of importance. At the time of the survey the tobacco plots had already yielded a crop of early millet of the bulrush variety (*Pennisetum typhoides*). This crop reaches maturity in early July and is harvested at the end of the month and in early August. It is also interplanted with guinea corn and after the millet heads have been harvested the stems are broken up and dug in as fertilizer for the growing corn. Its great value lies in the short growing season that it requires and its harvest provides the people with a food supply to carry them over, after consuming the products of the previous year's harvest, until the main guinea corn crop becomes available in November and December.

The greater part of the "fadamma" was devoted to the cultivation of dry-season tobacco having previously carried a crop of maize, the latter planted at the beginning of the rains and harvested in

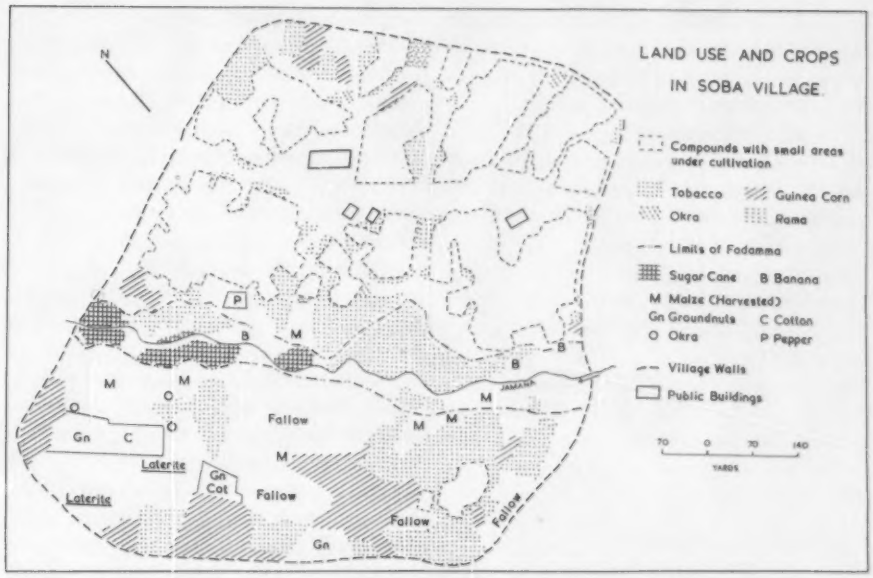

FIG. 7.

August. Soba is located far to the north of the main maize growing regions of Nigeria and the rainfall, which is below the requirement for successful growth, is supplemented by cultivating the crop in the "fadamma." The maize crop was formerly followed by sugar cane which was cultivated on into the dry season. In 1950 and 1951 there were severe losses of cane due to Red Rot, a fungus disease, previously unknown in Nigeria, which attacks the canes causing a red discoloration and a drooping and withering of the leaves. Heavy rainfall and resultant excessive water produce conditions favorable for Red Rot attack and in this respect it is interesting to compare the July, August, and September rainfall recorded at Maigana (the Department of Agriculture experimental farm, about seven miles from Soba along the Zaria road) in 1950 and 1951 with the average for those months over the period 1926–50 (Table I).

TABLE I

RAINFALL DATA FOR MAIGANA

(Rainfall in inches)

Month	*1950*	*1951*	*1926–50*
July	9.69	15.34	7.93
August	12.70	12.65	13.67
September	8.34	12.18	7.86

The disease had become very widespread in Northern Nigeria, having been reported from as far afield as Sokoto and Yola (Adamawa Province), but had been most serious in the main sugar cane areas of north Zaria. The Provincial Agricultural Officer estimated a 50 per cent loss in a "fadamma" of four square miles in Makarfi District devoted almost entirely to the cultivation of sugar cane. Informants at Soba spoke of farmers having made two or three unsuccessful plantings of cane and having then turned to the cultivation of tobacco. This change-over was undoubtedly accelerated by the favorable market for tobacco.

On the land to the south of the Jamana the crops being grown were the same as those in the zone of permanent cultivation outside the village walls.

In all categories of land, in addition to the important crops that have been noted, there are crops of minor importance (in respect of the amount of land which they occupy). They are important in the diet of the people contributing variety and flavor to the basic foodstuffs. The most common are sweet potatoes, pigeon peas, cowpeas, peppers, and risga (*Coleus dazo*). The last is a tuber cultivated in West and Central Africa, and in Nigeria for reasons unknown is grown largely in Zaria Province.

COTTON

With highly favorable climatic and soil conditions cotton is far and away the most important cash crop and long before the development of production for export Zaria Province was, ". . . not a great grain-producing province, . . . its chief crop appears to be cotton, which is exported to Kano."[8]

Building on this thriving native industry the British Cotton Ginning Association, the Department of Agriculture, the Empire Cotton Growing Corporation, and most recently the Cotton Marketing Board have expanded and improved production.

In 1912 seeds of Allen cotton (a variety of American Upland) were brought to Nigeria and a year later production of Allen cotton commenced at Maigana, the first agricultural experimental farm in Northern Nigeria. Here the seed was multiplied and distributed to the cotton growing areas as the major commercial variety until in recent years it has been superseded by the strain Samaru 26 C bred at the Northern Region Agricultural Experimental Station eight miles west of Zaria.

Soba, therefore, both traditionally and in view of modern developments, has been located most favorably for the cultivation of cotton. In the season 1952–53 it was the second most important market supplying the Zaria ginnery and in the previous three seasons it had been the second most important market in Zaria Province. Of greatest importance has been the availability of adequate transportation; in the first instance the light railway from Zaria which reached Soba in 1911 and subsequently the dry-season motor road which is now being developed into an all-season route with a bridge over the Galma river and embankments to carry the road through the "fadammas" which occur along its route. It is not possible to indicate precisely the area served by the cotton market at Soba but some indication is given from the map (see Fig. 8) showing the location of markets supplying the ginnery at Zaria.

Cotton is cultivated on both manured land and on land cultivated with fallow periods. The average area of land per farmer cultivated for cotton is between two to three acres, the larger farmers having from 12 to 20 acres. A large farmer may receive from £60 to £100 per annum for his cotton from an average return of £6 per acre.

TOBACCO

The development of this crop as a commercial product is much more recent than that of cotton, but in recent years it has made very rapid progress encouraged by the extension work of the Department of Agriculture and the Nigerian Tobacco Company. As with cotton Soba has been favorably located in relation to the development of commercial production. After initial experiments in the early 1930's it was decided

[8] Annual Reports, Northern Nigeria, 1901–1902, No. 476, 1904, p. 252.

to concentrate production on the Maigana area as having suitable climatic and soil conditions[9] and with the added advantage that farmers in the area were already acquainted with the extension work that had taken place with cotton. The tobacco grown is a variety of Virginia "Hybrid," which is used as a "filler" tobacco in the cigarette manufacturing industry established by the Nigerian Tobacco Company at Ibadan in the Western Region.

In 1934 the first three farmers were pursuaded to grow tobacco and the number was increased to 172 in the following year. From this time until the present day, except for occasional bad years, production has steadily increased, from 134 pounds in 1934–35 to over half a million pounds in 1950–51 (see graph, Fig. 9). The first buying station was opened at Awai, the station on the railway line for Maigana, in 1934, and as the growing area has expanded new buying stations have been opened. Figure 9 shows the location of these stations with the amounts purchased at them in 1949–50 and the year in which they were opened. It shows expansion from the original area of production which however still maintains complete dominance, and the importance of the railway for evacuating the crop at the beginning of the rains.

The bulk of production has come from the crop planted in seed beds at the beginning of the rains in May and then planted out in late July and early August on the farms which have carried a crop of early millet. The tobacco begins to ripen in late September, is harvested in November and then air-cured throughout the dry season. With the rise in humidity in the following April to May the leaves which have been very brittle become pliable enough to handle and are prepared for the market. More recently in the Zaria growing area there has been an increase in the dry-season cultivation of tobacco. This is a native method, now being developed for production on a commercial scale, which provides an interesting example of the farmers' detailed appreciation of available soil moisture. The crop is cultivated on the "fadamma," planting out from the seed beds commencing in September and October at the end of the rains and extending over a period of from two to two and a half months. The first seedlings are put in at the edge of the "fadamma" as the water table begins to fall and the soil begins to dry out. As the water table continues to fall planting is advanced inwards from the peripheries, the crop being dependent for its growth on the moisture remaining in the soil. The time of planting out is judged to a nicety so that there is not excessive moisture in the early stages and yet allowing at the same time sufficient moisture to carry the plant successfully through its stages of growth in the dry

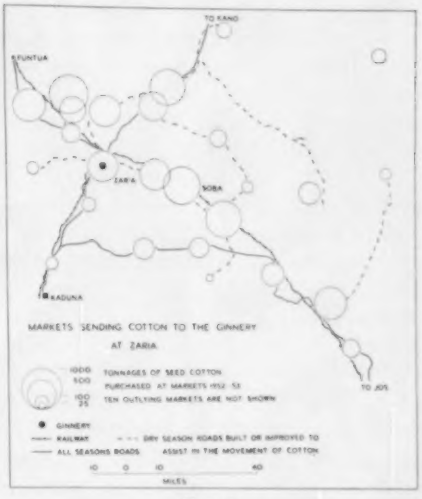

FIG. 8.

[9] D. Hughes Baker: "Cigarette Tobacco in Northern Nigeria," *Farm and Forest*, Vol. 6, 1945, p. 161, Ibadan.

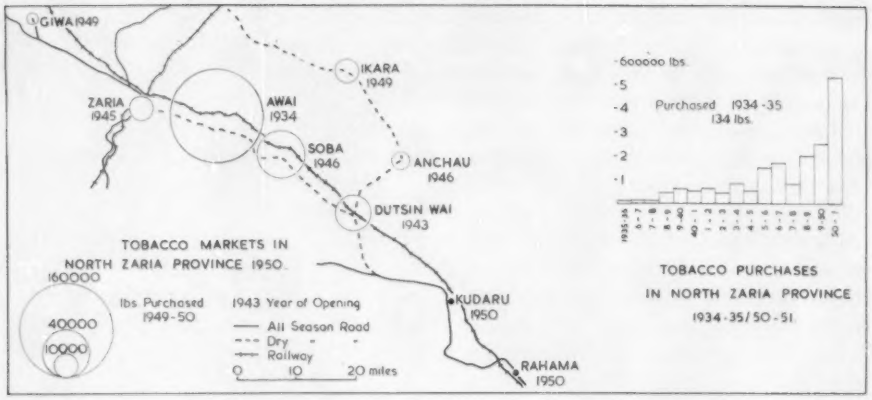

FIG. 9.

season. Harvesting commences on the edge of the "fadamma" and proceeds inwards as the crop reaches maturity.

There has as yet been no investigation made of the behavior of the water table in the "fadamma" areas and the amounts of moisture remaining in the soil at different times throughout the dry season. This should make a very interesting study though it is doubtful if its results would better in any way the techniques developed by the farmers' intuitive appreciation of moisture conditions.

At Soba the wet-season cultivation of tobacco does not extend outside the areas of manured land. The extension work of the Nigerian Tobacco Company discourages this practice as the increased nitrogen content in the manured soil produces a dark leaf which is strong in flavor and of a poorer quality than that preferred in the industry. The Company would prefer tobacco to be grown in the zone of cultivation with fallow periods as part of the rotation. At Soba to demonstrate this they established two farms of ten and seven acres respectively to the east of the village, the land being ridged along the contours and these ridges planted with grass to prevent soil erosion. One of these had been given to the District Head, but there was no evidence that any attempt was being made by the farmers to follow the advice given. Tobacco has been traditionally a crop grown on manured and among the Hausas farming traditions are hard to break.

Average yields are between 300 and 400 pounds per acre and can be increased by 25 per cent by the application of a small amount of superphosphate and sulphate of ammonia. Even more important for increasing yield is the need to remove flowers and suckers from the growing plant. The former is an accepted native practice as the flowers are used for staining the teeth in conjunction with the chewing of the kola nut; to pursuade farmers to adopt the second practice is much more difficult as it does not conform with custom. From an average acre yield the return is about £17.

SUGAR CANE

The cultivation of sugar cane was originally introduced into north Zaria by farmers from adjacent districts of Kano Province and was subsequently adopted by the local people. Native

production was for chewing only, and it was during the 1914–18 War that the Church Missionary Society introduced from America the first horse-driven crushers to lay the foundations of the brown sugar industry. Subsequently crushers were introduced from India. About 1926, again through the Church Missionary Society, sugar canes from the West Indies were tried out at Maigana.[10] It was found that though giving a higher quality sugar than the local cane they were unsuitable for chewing and that demand remains strong and has to be met. During the 1930's the industry declined and there was an estimated decrease of between 40 and 50 per cent in the amount of sugar grown during this period. In 1939 the first loans were made by the Department of Agriculture to farmers to purchase crushers, but the industry became fully revitalized with the demand for sugar which developed during the war. During the 1942–43 season crushers were distributed as indicated in Table II,

TABLE II

DISTRIBUTION OF SUGAR CANE CRUSHERS, 1942–1943

Adamawa..... 2	Zaria (including neighboring Kano districts).....93
Bauchi..... 3	Kano (remainder)..... 5
Niger..... 2	
Sokoto.....25	

showing the dominance of the Zaria area in production. The very scattered nature of the industry and the lack of any central organization makes it very difficult to give any close estimate of total production, and for the same reason it is difficult to envisage the setting up of any power-driven factory. Figure 10 shows the distribution of licensed crushers in the districts of north Zaria in the 1951–52 season when production was estimated at 2800 tons. Estimates of production are, however, further made more difficult by the operation of itinerant crushers which move between northeast Zaria and adjacent areas of Kano Province.

It is reckoned that the industry has not yet reached its economic peak, but there are several factors that limit its expansion. There is a shortage of good horses to work the crushers, a reflection of the difficulty of keeping animals in a tsetse-infested area. Firewood, which is required for boiling the juice after extraction, is in short supply in some parts and therefore costly. Cane and juice yields are being reduced by pests (white ants and stem borers) and by fungus disease (Red Rot). In view of the estimated reduction in production due to the latter in the Makarfi District, and the important contribution of this area to total production, it would seem that the prospects for the continued prosperity of the industry are not very good. The answer to Red Rot lies in the development of resistant varieties of cane and the use of fungicides, and experiments to provide these have been proceeding for some time.

The influence of the factors outlined

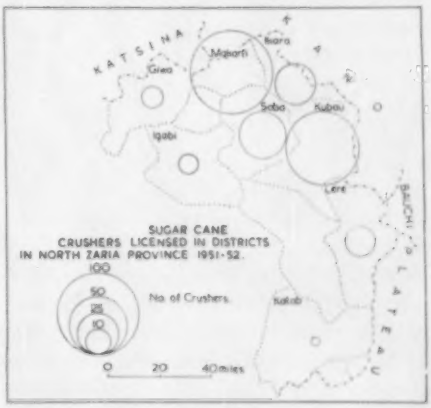

FIG. 10.

[10] W. E. Bond: "Sugar Production in Nigeria during the 1942–43 Season," *Farm and Forest*, Vol. 4, 1943, p. 124, Ibadan; J. W. D. Goodban: "The Zaria Brown Sugar Industry: Its Economics and Effects on Local Cane Production," *Ibid.*, Vol. 5, 1944, p. 185.

above is to be seen in the rise in the price of brown sugar from 3d. per pound in 1943–44 to 8d. per pound in 1951–52. It has risen also as a result of the presence of too many middlemen in the industry, a common feature with other commercial crops in Northern Nigeria. They reduce the price paid to the cane grower and the margin of profit to the crusher owner. There are instances in which the grower will dispose of his crop in the field direct to the crusher owner, thus eliminating the middleman, but with the damage liable to be caused by Red Rot crusher owners are unwilling to accept the risk of a loss by purchasing a crop which may yield them only a very small return. The general condition of the industry at the present time, the risks involved, and the low price that the grower can expect, should tend to accelerate the change-over from sugar cane to dry-season tobacco cultivation on the "fadamma" lands.

CONCLUSION

At Soba there are no problems of land use associated with a shortage of land (excepting the "fadamma") and there is ample available for the cultivation of food and cash crops. The fact that the village has more of its cultivated land under cash crops than under food crops, and as a result is not self-sufficient, is the outcome of a decision on the part of the farmers to utilize their available labor in this way. For the crucial problem which they have to face is that of being able to provide sufficient labor to deal with all the requirements of the land at particular periods of the farming season. There was evidence of more land having been sown with cotton than could be adequately cultivated. Under these conditions farmers are either forced to neglect their crop or to dispose of it in the field to middlemen who then harvest it with paid labor. In either case the farmer loses financially and the standards of cultivation and the quality of the crop are lowered.

The problem of sufficient labor is complicated by the fact that the farmer is cultivating a succession of crops and that the various operations required for each tend to overlap.[11] July and August are undoubtedly the most critical months. In the former the farmer has to deal with the sowing of cotton, the cultivation (weeding and ridging) of guinea corn, and towards the end of the month with the commencement of the early millet and maize harvest. In August the harvesting of the early crops has to be completed, guinea corn and cotton require re-ridging, and tobacco seedlings have to be transplanted. There is a very real congestion in the number of operations requiring attention, all of them critically important for a successful harvest. An added complication is the fact that food supplies at this time of year are at their lowest, those from the previous year's harvest having been used up and with two to three months still to go before the new main harvest of guinea corn becomes available. This seasonal shortage is reflected in the variations in the prices of guinea corn and millet during the year (Table III).

Guinea corn and millet reach their maximum prices in the months May–July, the latter usually in May–June, falling in July when the new millet harvest begins to come in. The arrival of this crop influences also the price of guinea corn which is generally highest in June–July and then begins to fall in August. General food shortages and resultant high prices cannot but have an

[11] In this respect it is doubtful if the introduction of mixed farming with working animals will improve the situation. The replacement of hoe by plow cultivation allows *more* land to be worked and means greatly increased supplies of manure but the tasks of sowing and particularly of weeding still have to be undertaken by hand.

TABLE III

PRICES PER TON OF GUINEA CORN AND MILLET IN NORTH ZARIA, 1950 AND 1951

Month	*Guinea corn £'s*		*Millet £'s*	
	1950	*1951*	*1950*	*1951*
January.....	..	18–19	..	25/10
February.....	18	20–21	18	25/10
March.....	18	22–23	18	25/10
April.....	..	22–23	20	28
May.....	18	26	18	28
June.....	28	20–22	28	18–20
July.....	30	18–19	21	23
August.....	23	16–17	19	8– 9
September....	22	16–17	18	9–10
October.....	18	15	18–20	10
November....	18	15	23	10
December....	15–16	15	24	18

Note: An annual slight rise in prices following the opening of the cotton marketing season in December–January.

ill effect on farming efficiency at a time when it is most required. Until recently the situation was further complicated by the fact that the taxes payable to the Zaria Native Authority were collected in July, adding further to the farmer's burden at this time of the year.

It will be further noted from the table that corn prices vary from year to year, related very closely to the success or otherwise of the harvest. This is influenced very considerably by the incidence of the rainfall, particularly during the planting months (Table IV).

TABLE IV

RAINFALL AT MAIGANA, NEAR SOBA

Year	*April*	*May*	*June*	*July*
1926–50....	1.35	4.76	5.58	7.93 inches
1949.....	0.18	0.73	6.75	3.50
1950.....	1.43	6.83	4.46	9.69

The low and sporadic rains at planting time in 1949 resulted in a poor harvest and high prices in the following year, in 1950 the situation was reversed with very much lower prices in 1951.

At the present time there is no competition for land between the different cash crops in the main areas of farmland. Cotton has been the traditional, and remains the most important cash crop. Traditionally tobacco is grown on manured land and therefore does not have to be found a place in the rotation with cotton and guinea corn in the farmland where cultivation with fallowing is practiced. It will be interesting to see if the efforts of the Nigerian Tobacco Company have any effect in promoting the cultivation of tobacco in this zone. In spite of its much higher return tobacco (£17 per acre) does not occupy anything like as much land as cotton (£6 per acre) in the area of manured land under permanent cultivation. The explanation for this is undoubtedly again to be sought in the problem of labor at the period of peak requirements. Tobacco cultivated on this land requires transplanting (an operation requiring much time and attention) from seed beds during the month of August. Cotton planting on the other hand can be integrated fairly well with the sequence of farming operations, coming in the latter half of June and early July after the food crops have been planted.

On the "fadamma" land, as a result of its small area and high value, there is competition from the different crops grown on it. There is little doubt that the dry-season cultivation of tobacco will expand at the expense of sugar cane, since for the reasons already given it guarantees a greater and safer economic return to the farmer. The planting out of tobacco seedlings in the "fadamma" integrates well with the farming calendar, taking place at the end of the rains in late September and October and being completed before the main harvest commences in late October and November.

The main area of farmland which

remains ample for present-day requirements is still allocated, on the basis of traditional land tenure, by the Village Head as land held by the community. Consequent on the high demand and short supply "fadamma" land is now bought and sold. In this way are modern pressures changing and, in some instances, breaking down traditional practice.

ACKNOWLEDGMENTS

The writer wishes to thank Dr. D. P. L. Dry, Anthropologist, who introduced him to Soba; the Provincial Agricultural Officer, Zaria; and particularly the people of Soba who cooperated to make the survey possible.

BOOK REVIEWS

The British Moorlands: A Problem in Land Utilization, by JOHN FRASER HART. viii and 98 pp.; maps, diagrs. University of Georgia Press, Athens, Georgia, 1955. $2.00. 8½ x 5½ inches.

Any visitor to Great Britain must be impressed by the remarkable contrast between the largely uncultivated, largely unpeopled hill country and the intensively cultivated, densely populated lowlands. Bearing in mind the straitened circumstances of the British economy, such a visitor will immediately wonder whether the country can afford to underemploy this full 30 thousand square miles of moorland. In this monograph, John Fraser Hart contributes his personal observations on "the optimum utilization of the British moorlands in terms of the present necessity for maximum terricultural production."

His book falls into three main sections—the moorland environment, moorland agriculture, moorland afforestation. The environmental picture sketches in structure, relief, and climate and then expands a little more fully upon the mantle of vegetation (pp. 18–22). In this section two difficulties arise. First, "moorland" vegetation is not easy to appreciate unless one is familiar with its constituents, and a page of sketches of the more common plants to which reference is made might have aided the American reader. Secondly, "moorland" terminology is in itself frequently lacking in precision and a problem for those who employ it. Useful bibliographical notes, however, will direct the reader to recognized authorities who will amplify the brief environmental summary. In dealing with agriculture and forestry, Dr. Hart is on firmer ground—marrying personal observations in the field with official reports, and drawing illustrations from selected farms and woodland plantations. The concluding chapter adds to the rival claims of farmer and forester those of recreation, water catchment, and military authority. The British moorlands may look deserted; but their space is nevertheless hotly contended.

The monograph is illustrated with 25 maps and diagrams, all drawn with boldness and clarity. Auchencairn, a hill sheep farm, and Enzieholm, a stock farm, are excellently illustrated. Their character might have been even more fully revealed if they had been presented as block diagrams—a method of representation not as fully explored as it might be by agricultural geographers. The series of maps to illustrate Gwydyr Forest is also most valuable. At least two diagrams would have gained by being specifically tied to place (Figs. 5 and 8); while some British geographers will debate the divisions given in Figure 3. It is a mere quibble to comment on the capricious appearances of the Isle of Man—save that it does have a moorland component to qualify it for regular inclusion!

The role of the moorlands in the rural economy of Britain is tied very much to marginal farming; though marginal farming, of course, is by no means tied to the environs of the moorland. There is clearly a zone about the so-called "moorland edge" of Britain which is highly sensitive to cultivation opportunities. The boundaries of the "moorland edge," founded upon generations of trial and error in farming practice, will be variable according to prevailing conditions. And, war years apart, there seems to have been an advance of moorland conditions into this zone. Since the preparation of Dr. Hart's manuscript, a paper particularly apposite to his theme has been published by G. P. Wibberley (*Geographical Journal*, Vol. CXX, Pt. 1, 43–61). The same theme is being more elaborately developed as a research project at Wye College in Kent, where economic geographers have been happily recruited to work with agricultural economists. A recent report by the *Welsh Agricultural Land Sub-Commission* (H.M.S.O., 1956) has, as the focus of attention, moorland edge farming in mid-Wales. The report touches upon a fact already brought forward by Dr. Hart—the scale of operations. It is clear that much marginal farming is ineffective because the size of the operating unit is too small. The large-scale family-operated farm, with a full five hundred sheep as its basic stock unit, has been recommended for hill farming in Scotland and Wales alike. At the national level, a Royal Commission on Common Land is currently pursuing its hearings and this must touch closely upon the issues of moorland management. The volume of Dr. Hart therefore appears in the full tide of fashion.

Though moorland transformation may be the cynosure of many enthusiasts it must be regarded in detachment. Given unlimited means for investment in it, much could be done. With limited means available, however, it is commonly more economic to invest in the already improved lands. In many parts of Britain these are not yielding their maximum, and the return from additional investment in them is likely to be greater than from that invested in marginal moorland. And independently of the matter of returns there is the time factor. "The total cost of improving marginal land averages £15–20

per acre. More than fifty years would be required to recover this capital investment," observes Dr. Hart (p. 44). It is a point which cannot be over-emphasized. Indeed, the long term character of improvement plans for these upland wastes is something which frequently discourages private enterprise within them.

This tends to throw automatically what Dr. Hart calls "the problem of the hills" back upon government authorities. And, traveling around the uplands today, one encounters increasingly frequent evidence of their direct intervention. The problems of the hills are in many ways unchanging, but the techniques available for solving them change rapidly. For economic and personal reasons, the private farmer cannot in general employ new techniques speedily and effectively. Dr. Hart does not play with that slightly discredited word "planning" in this connection; but it is evident, as he observes in his references to the Tweed Basin, that a rational program for the "optimum utilization" of particular moorland areas should be produced.

And what better approach could there be in this connection than the regional approach? Indeed, indirectly as well as directly, Dr. Hart's monograph makes one ponder much upon regionalism. For example, the issues involved in the differing, and detached, moorland areas impress that "the problem of the hills" must be approached regionally rather than nationally. And, on quite a different plane, this small book from the New World must serve to remind British geographers of the rich inheritance which they have in their neglected uplands for a whole series of regional monographs.

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The North American Midwest: A Regional Geography, JOHN H. GARLAND, Edit. viii and 252 pp.; maps, tables, bibliog., index. John Wiley and Sons, Inc., New York, 1955. $8.00. 10¼ x 7½ inches.

In the combined capacities of partial author and general editor, Professor Garland has brought together in this attractively printed book the work of fourteen other invited contributors, including Thomas F. Barton, Alred W. Booth, David J. De Laubenfels, James H. Glasgow, Robert J. Goodman, Harold L. Gray, Clyde F. Kohn, Walter M. Kollmorgen, James C. Malin, Harold H. McCarty, James E. Patterson, Hallock F. Raup, Joseph R. Schwendeman, and Stephen S. Visher. Following earlier regional volumes dealing with *The South* and *The Pacific Northwest*, this is the most recent addition to a series which is ultimately designed to cover all major geographic segments of the nation.

As the Preface states: "this book is concerned with the internal geographic structure of the Midwest. . . . The Midwest is definitely a nodal region with a clearly defined structure. It consists of an inner zone of several diverse regions, in one of which is embedded the second largest metropolitan core in the country, surrounded by a periphery of several diverse regions in which lies the indistinctly defined regional boundary. . . . Although a concept of total regions is employed, an exhaustive treatment is not attempted. Emphasis is placed upon the dominant qualities of the various human, cultural, and natural environmental associations. If the economic factors seem to be outstanding, it is because they are dominant in the Midwest, not that the book is intended to be an economic geography of the region."

The book is divided into four Parts and sixteen Chapters. Following an introductory part with its single chapter entitled "The Heart of a Continent," Part II, "Midwestern Elements," includes five topical chapters dealing with Weather and Climate, Settlement Forms and Patterns, Agriculture, Industry, and Trade and Transportation. The remaining chapters are individually devoted to ten sub-regions of the Midwest. The four chapters of Part III, "The Inner Midwest," deal successively with: The West-Central Lowland; The East-Central Lowland; Eastern Lower Great Lakes; and the Upper Mississippi Valley. In Part IV, "The Mid-Western Periphery," are found descriptive analyses of: The Upper Great Lakes; The Upper Ohio Valley; The Lower Ohio Valley; The Ozark Upland; The Lower Missouri Valley; and The Upper Missouri Valley.

At many points one is pleased to find that this is not, in the manner of all too many texts, simply a routine compilation. There is a welcome freshness to much of the material and a creativeness involved in its interpretation. Considering the complexity of the region and the wealth of available data concerning it, the over-all treatment is one of restrained brevity. Indeed, in numbers of pages involved, the total book is not substantially larger than the space devoted to the same geographic coverage in existing standard texts which deal with the whole of Anglo-America. The reader finds himself wishing from time to time that the authors had permitted themselves the luxury of including somewhat greater detail. In this respect the volume is characterized by the succinctness of a tightly organized text rather than the elaboration of a reference work.

Although all aspects of the physical geography of the Midwest are discussed in the separate regional chapters, one wonders why weather and climate are the only such topics included among the systematic chapters in Part II. The general perspective of the reader would surely have been strengthened by the inclusion of similar broad treatments of land forms, and soils and natural vegetation.

There is a cohesive standardization of approach and writing among the several chapters to a

degree uncommon in volumes produced by so large a number of different authors. The chapter on Trade and Transportation, which is about twice the length of any other section of Part II, and the chapter on the Lower Ohio Valley in Part IV seem overly long when compared with the other portions of the book, but by and large a remarkably effective balance of space allotment has also been maintained.

The book contains a generous collection of useful maps, and with but one or two notable exceptions they are clear, readable, and instructive. Surprisingly, and it would seem unfortunately, there are no photographs of any kind. For the student who is not acquainted with the North American Midwest through personal experience, thoughtfully annotated and well selected pictures could have been an enormous aid in visualizing various aspects of this virtually unique part of the world.

JOHN C. WEAVER

Kansas State College

Économie et Espace: Essai d'integration du facteur spatial dans l'analyse economique. (Economics and Space: A study of the integration of spatial factors into economic analysis), by CLAUDE PONSARD. Vol. VIII in the series "Observation Économique"; xvi and 467 pp.; tables, diagrs., bibliogr. Sedes, Paris, 1955. 10 x 6½ inches.

The recent evolution of Location Theory as a connecting link between Economics and Geography has been extremely confusing to many geographers. To some extent this is due to the absence of satisfactory examples with which geographers could test the validity of the theories propounded. Contradictions between the various theories resting on different sets of assumptions are an even more important source of confusion. Professor Ponsard now has attempted to remedy the latter deficiency by presenting an excellent "intellectual balance-sheet" (p. v) of location theory in a novel framework. Although his book is written primarily for economists, its lucid evaluations of the very complex material should also appeal to geographers.

In Ponsard's framework, spatial relations or location factors are regarded as akin to a magnetic field. The poles in this framework are economic-decision-making individuals or institutions which act on state, regional, or local levels. Each pole possesses a supporting space as well as a geographical horizon which delimits the area of its thinking. Individual poles are related to other poles as well as to the totality of space by means of what economists call "external economies." Within this universal framework Ponsard describes spatial relations at various levels of activity—for example at the level of competing firms (micro-economic-geography), or at the level of sovereign states (political geography). The framework then permits the establishment of systematical relations between the theories observed at the various levels of investigation, for example between Weber's micro-economic theory of location and von Thünen's theory of intra-regional relations. This procedure results in the most comprehensive presentation of location theory available today. The author realizes that location theory is still in the relatively early stages of its evolution, which results in gaps in his presentation; however, his framework should facilitate further elaboration of the theories, particularly by geographers.

Ponsard regards heterogeneity in space—a raison d'etre of geographers—as a function of the multiplicity of the activity of poles. However, the question of the number and distribution of poles in any given area is not investigated, which prevents a transition from the purely geometric space of the economists to the spatial concepts of geographers. The realization of this deficiency may indicate an approach which would permit an advance from von Thünen's concepts of a uniform plain which has so far dominated nearly all investigations in location theory towards the reality of space as seen by geographers.

Political geographers will be interested in the discussions of Lösch's outstanding contributions to location theory. Ponsard describes how Lösch, despite his personal liberal outlook, "supplied for the German Lebensraum doctrine a scientific substructure by providing analytical elements . . . for its internal logic" (p. 224). Other observations, particularly on the relations of space and time, will interest geographers who dare to study these subjects in a French which exceeds conventional high-school standards.

ALEXANDER MELAMID

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World Economic Geography, by EARL B. SHAW. vii and 582 pages; maps, ills., index. John Wiley & Sons, Inc., New York, 1955. $6.50. 6 x 9 inches.

This readable, interesting, and teachable book by Dr. Shaw gives many not-readily-found details. Generous footnotes provide more up-to-date information, items of historical background, and quotes from other sources. The sub-title adds the phrase, "With Emphasis on Geographic Principles." The reader will find throughout every chapter that basic understandings are pinpointed by the use of summary statements and that topic sentences focus attention upon the principles being developed. Paragraphs are well planned and develop the content in an unusually well ordered and logical sequence.

In addition, the author makes words count for more than merely completing a sentence. He brings in associated and related facts which

enrich teaching and learning experiences. For example, in telling about the sending of iron ore to the lake head ports, he writes, ". . . railroad cars . . . move downgrade to the glacially formed Great Lakes. . . ." Again and again, descriptive details give the seasonal picture of activities of farming, mining, fishing, and logging. The reader gets the feel and flavor of a region and its work and problems.

There are 20 chapters divided into five parts: 1, Economic Geography: Meaning and Approaches; 2, Forest, Fish, and Animal Industries; 3, The World's Agriculture; 4, Manufacturing and Trade; 5, Population. Some 340 visual aids add to the content: pictures, maps, graphs, and diagrams. Outline maps of the world's political units for identification and location reference are used as end pages. Selected references, well chosen questions, and problems summarize every chapter. Wherever appropriate, tables of data and "place geography" lists appear. An example of the latter is "Place Geography of the Forest Industries," giving the Products and in the opposite column the Producing or Shipping Areas. These lists can serve a useful purpose if the student follows through in the map work necessary to locate the places. Certainly, questions should arise from a study of the spotty patterns that result. Relationships between the data mapped and other factors should also be noted.

In the opening chapters, the author uses an original and different orientation to economic geography. Not only by definition and words, but, better still, by the use of examples, four approaches to the study of economic geography are illustrated. The *commodity* approach takes the economic geography of rubber as an example. In the *regional* viewpoint, exemplified by Guatemala, the regions of that country are located, described, characterized, and interpreted. The *activity* approach is developed and illustrated by the example of the Commercial Corn-Mixed Farming; and the *principle* approach is applied to the unit on the Exploitation of Minerals.

Throughout, conditions of climate, soils, relief, and location are examined as significant geographic factors. The social, political, and economic factors are given adequate attention, in so far as they interact and react upon people and their ways of living and working in their home regions.

In the Preface, the author states: "No attempt has been made to include all there is to know about economic geography. The main purpose lies in an emphasis (1) upon principles and upon examples to explain principles; (2) upon physical and man-made factors as they show relationships to make a living; and (3) upon an inclusion of sufficient factual material, together with an analysis of it, to provide the undergraduate student with a general knowledge of geonomics."

The techniques used in the approach to and the development of topics, and the analysis of problems set practical patterns by which the student can undertake further study of additional topics. The book reflects Mr. Shaw's keen understanding and appreciation of effective teaching methods and materials and scholarship.

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Movements of the British Iron and Steel Industry —1720 to 1951, by HOWARD G. ROEPKE. vii and 198 pp.; maps, tables, bibliogr., index. University of Illinois Press, Urbana, Illinois, 1956. $4.00 ($3.00, paper cover). 10 x 6¾ inches.

The main purpose of this work is to bring between two covers a general survey of the locational changes which the British iron and steel industry has undergone during the last two and a half centuries. It is alleged, with some reason, that no geographer has previously done this and that the major studies have been made by economists or economic historians. It is also alleged, though this may be disputed, that "certain previous interpretations of the historical distribution of the industry were open to serious question."

Naturally enough, therefore, nothing new emerges from it. The whole story is well enough known to British geographers, and possibly that is why none of them has ever bothered to write it up as a consecutive story before. There is plenty of statistical information available from the 1850's onwards—though it often changes its form and needs great care in its interpretation—and a few well-worn sources prior to 1850. Ashton, for the Industrial Revolution period, Burnham and Hoskins for the post-1870 period, and Burn in a more general survey have been widely drawn upon by Dr. Roepke, but his bibliography does rather less than justice to the geographical literature which exists, and he ignores completely the work of the Geological Survey on iron ores. Thus his only references on iron ore are books published in 1893 and 1922, and in quoting the economic historian Burn on the ore reserves of the East Midlands (pp. 164, 183) he appears to be completely oblivious of the Geological Survey's recent (1951–52) Memoirs on this subject.

Dr. Roepke's only apparent example of the "interpretations open to serious question" is that of the orientation of the iron industry towards the coalfields during the Industrial Revolution. He maintains that coal has been over-emphasized and that, in fact, it was iron ore (occurring in the Coal Measures) which was the main localizing factor. There is, of course, considerable force in this argument; but

the vital point, missed by Dr. Roepke, is that the location of the industry was conditioned by the coincidence of iron ore *and coal suitable for coking by the then available method*, i.e., coal of 78–79 per cent carbon content which, in large lumps, could be coked in heaps in the open. Only certain areas of certain coalfields fulfilled both requirements, and in these areas the iron industry congregated. With the introduction of the beehive oven, using higher ranking coals, (85 to 89 per cent carbon) which were crushed before coking, other areas came into the picture, but by that time the earlier locations were firmly fixed and coking coal by itself (as in S. W. Durham for example) never succeeded in attracting a large iron industry anywhere.

Any work on the British iron and steel industry is bound to be handicapped somewhat by the nature of the statistics available and by their regional grouping. The iron and steel industry is composed of a series of producing units, large and small, isolated and congregated, owing their origin to a great diversity of locational factors, and subjected to a multiplicity of economic influences. In some areas the statistical subdivisions of the Iron and Steel Federation correspond fairly neatly to more or less homogeneous geographical areas, in which physical and economic conditions are largely uniform for all the works in the area (e.g., N. Lincs., and in large measure the N. E. Coast). In other cases the statistics either conceal important sub-regional differences (e.g., South Wales) or relate to a collection of producing units so diverse that the figures are almost meaningless. Thus the "odds and ends" region (2 and 3 in the Federation's numbering), comprising Lancs., Cheshire, N. Wales, W. & S. Yorks, includes such diverse plants as an integrated inland coalfield works at Rotherham, a "coastal" integrated works alongside the Ship Canal near Manchester, a relic of a past industrial age on the N. Wales Coalfield, a "pure" (non-integrated) steelworks in Manchester, and a specialized ferro-alloy works on the N. Wales coast; for some purposes the region includes Sheffield, for other purposes Sheffield is regarded as a separate region. Can omnibus figures for iron and steel production in such a "region" mean anything at all, either economically or geographically? The only way of understanding the figures is to acquire a detailed knowledge of the plants in question, their exact location and siting, and their history. Obviously Dr. Roepke did not have time to do this, and his work—particularly in respect of S. Wales, Scotland, and Sheffield—suffers somewhat in consequence. For example, on p. 75 we read that in 1900, in S. Wales, there were 17 blast furnaces "on the coast." This is nonsense, but it still does not make much more sense when we are told on p. 90 that, in fact, the number 17 refers to "iron and steel plants." There were indeed only two iron-smelting plants literally on the coast—at Cardiff and Briton Ferry—and two "pure" steel plants. The remainder of the 17 plants (almost all "pure" steelworks) were inland—anything up to ten miles—and mostly in the hinterland of Swansea and Llanelly.

Again on pp. 87–88, Northamptonshire is several times referred to as a steel producing district before World War I, whereas, in fact, the first steelworks commenced only in 1935 (which Dr. Roepke refers to on page 121). On p. 105 we read that the "steel-making plant in Scotland" was badly placed for the use of foreign *ores* (reviewer's italics) on which they had to depend. Dr. Roepke seems largely unaware that in Scotland iron-smelting and steel-making were two absolutely distinct industries—historically, economically, and geographically. The confusion on Scotland is added to on pp. 149–50 where this area is classed as "coastal" despite the fact that not a single plant is on tide-water; surely Scotland should be classed with "inland sites based on coal, scrap and market" (p. 154).

These criticisms are points of detail and detract only slightly from the merits of the whole work. They may not matter very much for an American reader who wants only the general picture. But the detail is absolutely vital, and too superficial a study cannot succeed in shedding the light on American problems, which Dr. Roepke hoped for. The treatment of the modern period is on the whole sympathetic and shows greater appreciation of detail, though perhaps it does inadequate justice to the factor of inertia, to the intimate regional and local linkage of iron and steel production with other industries, and to the immobility of British labor. Dr. Roepke complains about the non-appearance of a new integrated works on the Clyde—but, if he had examined the banks of the river in detail, he would soon have come to the conclusion that there is indeed no feasible site for such a plant; and a vast new works is now being erected on a virgin site in the heart of the old steel-making area, near Motherwell. Further he opines that there should have been another new integrated works on the E. Midland ore field. The best brains in the industry have yet to find an actual site which is developable for such a project, with all the facilities such as accessible and continuous ore reserves, railway lines, accommodation for labor, etc. This part of England has been inhabited and intensely used for more than two thousand years, and one cannot just lightly carve up such a landscape for heavy industry.

Finally, a word about the maps. They are not geographers' maps. Most of them are based on county or wider regional statistics. The Federation's regions to which some of them relate are never shown on the maps, and the block symbols are often most misleadingly placed—especially of Figures 14 and 15. There

is but a very poor and sketchy map of coal and iron fields, and no map at all of the present location of iron and steel plants.

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Land Uses in American Cities, by HARLAND BARTHOLOMEW, assisted by JACK WOOD. x and 196 pp., plates, tables, index. Cambridge, Harvard University Press, 1955. $6.50. 10¼ x 6½ inches.

Land Uses in American Cities, a valuable contribution to the literature on urbanism, supersedes a book by the same author issued 20 years ago under the title *Urban Land Uses*. The previous study analyzed 22 cities; the present one considers 97 cities. A total of approximately 200,000 acres of urban land was mapped. Fourteen tables in the appendix record the data accumulated, categorizing cities by population class as well as by the designations "central city," "satellite city," and "urban area."

To provide a "common denominator" of urban land use, the author deducts vacant and agricultural land from the total area of cities, leaving a figure which he terms "developed area." Using ratios of the several urban land uses to developed area provides a method for direct comparison of uses from city to city. To relate use to population the uses are presented as ratios of "acres per 100 persons."

Ready comprehension of the analytical discussions in the text is provided by the use of numerous short summaries of the data, obviating the necessity for reference to the complete tables in the appendix.

As the author points out, the central theme of the book is oriented toward comprehensive zoning. To those seeking specific information with respect to preparing a land use inventory the book also provides a step by step description of the process.

Geographers may suffer some disappointments as they turn to this book for information. The distribution of the cities studied is far from uniform. The greatest concentration occurs in the Midwest; there is a scattering in the East and South; and only four cities in the eleven western states. The inclusion of such atypical urban places as Williamsburg, Virginia, and Beverly Hills, California, although not a serious drawback, would seem to add little to the validity of the study. Even though eleven "urban areas" are analyzed, such an area is not specifically defined. It does not seem sufficient to say that the urban area is comprised of a city and its fringe, when the limit of the fringe is not specified. Surely the area "between city and country" had to be delimited to be able to measure the land use acreages. Other readers may well object to the use of "central city" for places with fewer than 50,000 inhabitants and question the implication that a "satellite city" can be considered as synonomous with a "suburb."

Despite minor drawbacks, students of urbanism will find this book a valuable reference tool.

BRUCE C. OGILVIE

Chico State College

World Sea Fisheries, by ROBERT MORGAN. xiv and 307 pp.; maps, ills., diagrs., tables, statistical appendix, subject index. Pitman Publishing Corporation, New York and London, 1955. $6.95. 8½ x 6 inches.

Here at last is that rarest of current literary phenomena: a book that actually lives up to the claims printed on its dust jacket! Certainly no other recent publication in English can compare with *World Sea Fisheries* in acquainting the reader with "a comprehensive world survey of the fishing industry, giving the essential information, and discussing the basic factors which mould the character of the fisheries in a region." Morgan's book was written on the assumption that some of its readers would not be too familiar with those components of the geographic environment which explain why every portion of the ocean-covered globe is not or cannot be utilized for fishing. Hence, the first section is concerned with the physical and biological factors accounting for the relative "fish-richness" of these waters. Diagrams based upon relatively recent data well illustrate the salient features and world distribution for commercial exploitation of the main types of sea fish and shellfish.

Section II discusses the relationship between the natural environment and the use of various types of fishing methods as well as vessels and other equipment. Factors determining the manner of processing and marketing of fishery products are enumerated with special consideration of those industries ancillary to commercial fishing. The location and development of fishing ports is also analyzed, with many ports of Great Britain being used to illustrate the controlling factors.

The final section provides suitable criteria for a broad evaluation of the fishing economy of each of the continental realms including the Antarctic whaling regions. The relative importance of each is compared with that of other areas, followed by an evaluation of the importance of each country's fisheries to its economy. Thus, some readers may be surprised to learn that among European nations, the Portuguese have a per capita consumption of fish almost as great as that of Norway and Iceland and two and one-half times as great as that of the United States. Those Portuguese

fishermen who have joined their countrymen in the current stream of emigration to Angola are currently exploiting the rich fisheries of the Benguela Current to such an extent that, of all African political units, Angola now is second only to the Union of South Africa in its fish catches. Its current landings exceed those of every country in the Western Hemisphere except Canada and the United States.

For all students and professors interested in the increasing economic significance of fishery production, for all conscientious citizens concerned with the conservation of a vital natural resource, for the scientists of every nationality seeking to discover new sources of food for the world's rapidly expanding population, for these and everyone who has ever played at fishing, *World Sea Fisheries* is an excellent, exhaustive source of information about the much overlooked and therefore little appreciated commercial fishing industry.

RICHARD J. HOUK

De Paul University

The Urban Development in South-Central Ontario, by J. SPELT. 10 and 241 pp.; maps, charts, tables, bibliogr., place index. Van Gorcum & Comp. N.V., Assen, Netherlands, 1955. $5.00. 9½ x 6¼ inches.

Anyone with an interest in the influence of large metropolitan settlements on the growth and function of smaller urban centers will find Dr. J. Spelt's book, *The Urban Development in South-Central Ontario*, a provocative empirical study in urban geography.

In his introduction, Dr. Spelt sets forth this problem: To what extent has the expansion of Toronto affected the growth of other cities and towns in South Central Ontario? In order to find the answer to this question the author adopts an historical approach. His analysis is divided into five parts, each covering a period in the history of South Central Ontario. His description of each period includes a survey of population density and a discussion of the region's economic activities, including agriculture, lumbering, manufacturing, and transportation. Finally, the pattern of urban settlement of each period is analyzed. A special attempt is made in each part to describe the urban centers on the basis of their functions, after which the towns are compared as to their growth and decline. Although a good deal of emphasis is placed on Toronto because of its dominant position in South Central Ontario, Dr. Spelt discusses in detail other urban centers. His tables and maps are helpful and an extensive bibliography is included.

The first section deals with the era of early settlement, 1780–1820. During this period, Toronto was started on the road toward metropolitan predominance not by its economic strength, but by deliberate actions of a self-interested governmental clique. The only other urban settlement of significance to appear during this period was that of Kingston.

The second period dates from 1820 to 1850 and is known as the period of Northward Expansion. At this time the transportation system of South Central Ontario underwent considerable change and many improvements took place. These were reflected in the general economic and urban development of the region. There were important shifts in external trade which affected South Central Ontario, and there were profound modifications in the pattern of trade routes, particularly in the Lake Ontario subregion. As a result of these changes, Toronto grew rapidly. Its commerce became more important than its function as a capital. Its situation enabled the city, during the latter part of this period, to lay the foundations for its growing importance over the whole of South Central Ontario.

The third period witnessed the building of railways and covers the years 1851–1881. Urban growth during this period became dependent upon the development of rail facilities. In 1851 the larger urban centers were ports and transshipment points. Thirty years later, the main villages and towns were district and regional service centers. Their distribution was closely related to the rail network. During this period, Toronto was able to benefit from a transit trade via the Toronto Passage. This helped to make Toronto a major grain market and the largest exporter of Canadian wheat across the lake to the United States. In addition, the Northern Railway brought a tremendous lumber business to the city. Toronto also began to compete with Montreal as a center for wholesaling and finance. Thus, by 1881, the city had become the unchallenged leader of the Province of Ontario and a powerful competitor of Montreal.

The years 1881–1911 mark the fourth period discussed by Dr. Spelt. This was the era that saw the rise of modern manufacturing. Traditional local industries in all of the small and large centers gave rise to the modern factory in only the large towns and cities. This, in turn, led to a population decline in many small villages. Toronto benefited most from this development. By 1911, it had about 70 per cent of the workers employed in manufacturing in all of South Central Ontario, with some of the largest industries of the province concentrated within the city limits. Dr. Spelt states that the decline in manufacturing in the smaller urban centers occurred mainly through the influence of Toronto and a few other cities and towns. The concentration of modern industries within Toronto and the expansion of its trade and finance made it the indisputed leader of Ontario.

The final period, from 1911 to 1951, has been characterized by Dr. Spelt as the period of urban predominance. Presently, there appears to be a

tendency towards a slower growth of metropolitan Toronto and a decentralization of industries. These recent trends, Dr. Spelt believes, suggest that perhaps Toronto is approaching its maximum size.

It is interesting to compare Dr. Spelt's findings regarding urban development in South Central Ontario with those of Donald Bogue's which are outlined in his *Metropolitan Dominance and Sub-Dominance*. The history of urban development of South Central Ontario demonstrates many of the hypotheses set forth by Bogue. Dr. Spelt finds, moreover, that after 150 years of urban growth, the present pattern in South Central Ontario is more dynamic than ever before. He suggests that in order to reach a balanced urban pattern, a regional plan focused on a controlled growth of Toronto is necessary if a desirable climax settlement pattern of South Central Ontario is to be achieved.

Dr. Spelt's book contains a storehouse of information on the growth, function, and distribution of cities and towns in the South Central Ontario, and the extent to which Toronto has affected the urban pattern of this region.

CLYDE F. KOHN

Northwestern University

The Theory of Economic Growth, by W. ARTHUR LEWIS. 453 pp.; index. George Allen and Unwin Ltd., London, 1955. Thirty Shillings. 9 x 6 inches.

Except in location studies economic theorists have in general been little aware of the concepts, methods, and works of economic geographers. To some extent this is the result of specialization; a more significant cause may be the non-spatial nature of most of the recent advances in economic theory. The present interest in underdeveloped countries has, however, drawn the attention of some economists to the problems of size and distances, and thus geography. It is not surprising therefore that this theoretical but well written and lively work, which attempts to generalize the experiences of the economically developed countries as a guide to the underdeveloped parts of the world, should frequently refer to the concepts and works of geographers.

The Theory of Economic Growth is concerned with raising per capita output. Since increased output is a function of the available resources, the question arises "whether there is a connection between the richness of resources and the quality of the human response" (p. 53). The author answers this question positively for one aspect of resources, namely accessibility, which he defines as stemming "from geographical features—the surface layout of the country, its rivers, its access to the sea, the quantity and quality of its harbours . . ." (p. 53). Accessibility thus defined is then explored in some detail, while concepts of economic theory, like values, economic institutions, etc., are being introduced. For example, if the costs of accessibility were zero "the whole world would constitute a single market; even the smallest country could then specialize, and sell its surplus to others, in return for what it wishes to consume" (p. 72). Under these circumstances only the intrinsic quality of the resources would determine economic growth. In reality costs of accessibility are nowhere zero. If in any country this cost is low, values will fluctuate frequently due to the impact of production elsewhere. In that case economic institutions will tend to be flexible and permit rapid economic growth. In contrast, if costs of accessibility are high, adjustments are limited; economic institutions tend to be inflexible and rarely permit rapid economic growth. Lewis observes "that resources influence the human response through the cumulative effect of economic growth" (p. 54). Since economic growth is shown to be partly a function of accessibility, a geographical determinism is exhibited which in this loose form should be acceptable to most economic geographers

The argument and its many ramifications (capital, labor including slavery, migration, etc.), are illustrated by examples from all continents; outstanding among these are the many references to the West Indies which should attract the attention of area specialists. Among minor points of interest to geographers are the clarification of land titles (p. 91) and detailed maps (p. 203) needed as a prerequisite of economic development.

Many experts will disagree with the population theories utilized by the author. Geographers may also query his definition of the frontier as "a place which is geographically remote from the commercial capital of a country" (p. 151). Despite these and some other defects the book is unique in having brought together within the framework of economic theory all the various factors, including geography, which contribute to economic growth, and thus to hopes for better living for mankind.

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